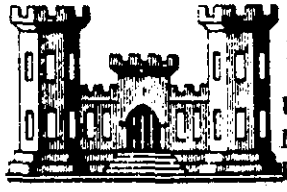
407-444

HOUSATONIC RIVER BASIN
DANBURY, CONNECTICUT

EAST LAKE RESERVOIR DAM

CT. 00066

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JANUARY 1979

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East Lake Reservoir Dam

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
East Lake Reservoir Dam is an earthfill embankment about 550 ft. long with a maximum height of about 36. ft. The original dam has been raised and widened to accommodate a local road. The spillway is located at a natural saddle and draw about 300 ft. to the left of the left abutment of the dam. A 15 ft. span bridge constricts the spillway outlet channel. The main outlet is a 16 in. dia. pipe through the dam with a blowoff valve below the toe. A 12 in. dia. pipe connects the outlet pipe to Margerie Lake Reservoir. A second pip e outlet, 12. in. dia., is located near the left abutment.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

MAY 2 1979

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

I am forwarding to you a copy of the East Lake Reservior Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, City of Danbury, City Hall, 155 Deer Street, Danbury, Connecticut 06810, ATTN: Mr. Ralph Welch, Superintendent of Public Utilities.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

EAST LAKE RESERVOIR DAM

CT 00066

HOUSATONIC RIVER BASIN
DANBURY, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.	CT 00066
Name of Dam:	East Lake Reservoir Dam
Town:	Danbury
County and State:	Fairfield County, Connecticut
Stream:	East Lake Brook
Dates of Inspection:	9 & 14 November 1978

BRIEF ASSESSMENT

East Lake Reservoir Dam is an earthfill embankment about 550 ft. long with a maximum height of about 36 ft. The original dam has been raised and widened to accommodate a local road. The spillway is located at a natural saddle and draw about 300 ft. to the left of the left abutment of the dam. A 15 ft. span bridge constricts the spillway outlet channel. The main outlet is a 16 in. dia. pipe through the dam with a blowoff valve below the toe. A 12 in. dia. pipe connects the outlet pipe to Margerie Lake Reservoir. A second pipe outlet, 12. in. dia., is located near the left abutment.

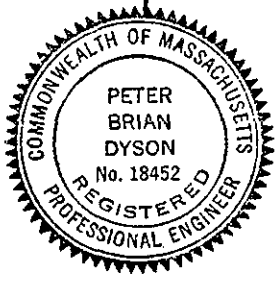
East Lake Reservoir is utilized as a water storage facility for the City of Danbury. It is about 2,600 ft. long and has a surface at normal storage of 71 acres. The drainage area is 1½ square miles and the maximum storage to the top of the dam is 1,400 acre-ft.; the size classification is thus intermediate. Because of the threat to life and property which would result if the dam was breached, it has been classified as having a high hazard potential. Marshy areas below the dam indicate probable leakage from the reservoir in the vicinities of the two outlet pipes. The serviceability of the outlet control and blowoff valves is doubtful. Both sides of the roadway across the dam are unstable and sloughing down. The dam is judged to be in fair condition.

The spillway capacity is inadequate to pass the full PMF test flood outflow of 6,050 cfs; it would pass 50% of the test flood. The test flood would overtop the dam by about 1.7 ft. and the spillway discharge would be 1,750 cfs.

Within one year of the receipt of the Phase I Inspection Report the owner, the City of Danbury, should retain the services of a competent registered professional engineer and implement the results of his evaluation of the following: (1) the need for additional spillway capacity; (2) whether the bridge across the spillway outlet channel should be lengthened or the channel deepened; (3) the need to provide for adequate support of the roadway across the dam.

The owner should also implement the following maintenance measures: (1) remove and control growth on the slopes of the dam and at the downstream toe; (2) isolate seepage zones and monitor them monthly during periods of high reservoir level; (3) control rodent infestation of the embankment; (4) check that all valves are serviceable; (5) develop a formal flood warning system and emergency operational procedure; and (6) institute procedures for a biennial periodic technical inspection.

Peter B. Dyson
Project Manager



Frederick Esper
Vice President

This Phase I Inspection Report on East Lake Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph W. Finegan, Jr.

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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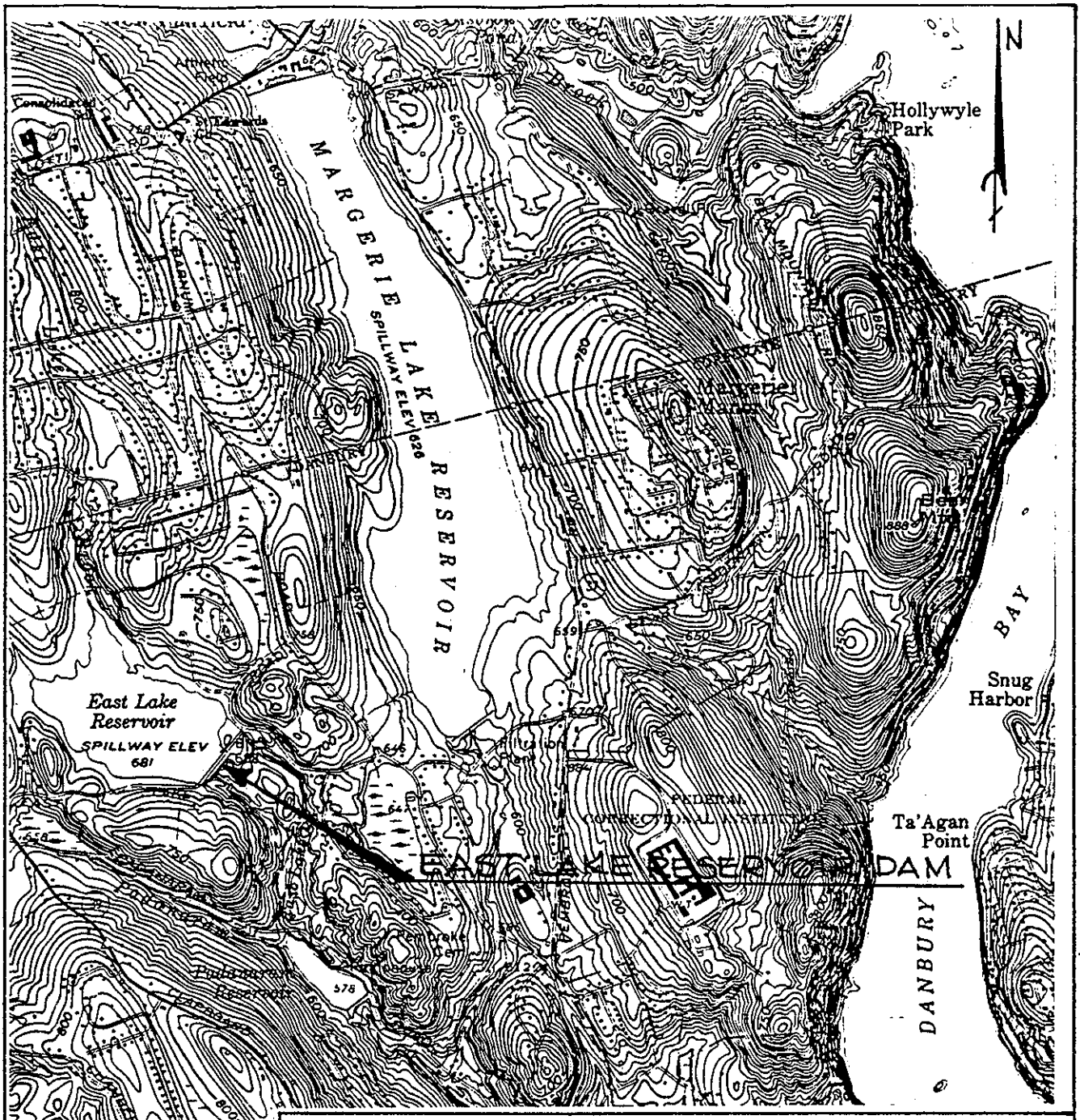
EAST LAKE RESERVOIR DAM

Overview from left abutment

Overview from right abutment



LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

EAST LAKE RESERVOIR DAM

DANBURY QUADRANGLE

HOUSATONIC RIVER BASIN **STATE - CT.**

			SCALE 1:24000
			DATE

PHASE I INSPECTION REPORT

EAST LAKE RESERVOIR DAM CT 00066

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Louis Berger & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Louis Berger & Associates, Inc. under a letter of 27 October 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0371, Job Change No. 1, has been assigned by the Corps of Engineers for this work.

b. Purpose

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

3. Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

East Lake Dam and Reservoir are located about 2½ miles north of the City of Danbury in Fairfield County, southwestern Connecticut. The reservoir is about ½ mile west of Margerie Lake Reservoir and is operated in conjunction with that and other water storage facilities to supply

water to the City of Danbury. The reservoir is situated on East Lake Brook, a tributary of Padanarum Brook, which joins the Still River in North Danbury about 3.5 miles downstream from East Lake Dam, where the elevation is about 385. The normal storage level of East Lake Reservoir is at elevation 681, or about 55 ft. higher than Margerie Lake Reservoir. Storages released from East Lake Dam are conveyed by pipeline into Margerie Lake Reservoir, from which water is drawn into the filter plant serving these facilities.

b. Description of Dam and Appurtenances

1. Description of Dam

East Lake Reservoir Dam is an earthfill embankment about 36 ft. high at its maximum section and about 550 ft. long. The dam was constructed of puddled and dry embankment fill. It has a central concrete core wall extending from a core trench excavated to bedrock to within 6 ft. of the top of the dam, and for the full length of the dam.

The dam was originally built with its top to about elevation 681, with a 15 ft. wide crest and upstream and downstream slopes at 2 to 1. At some later time the crest of the dam was raised about 5 ft. by extending the upstream slope at 2 to 1 and by steepening the upper portion of the downstream slope to 1½ to 1. The original 15 ft. crest width was increased to 20 ft. by steepening the top 5 ft. of the upstream slope to approximately 1 to 1.

The central core wall now extends to within 6 ft. of the crest of the dam. The wall increases in thickness in steps, starting with a 2 ft. thickness at the top and varying 6 in. every 5 ft. as it extends downward. The base of the wall was placed in a core trench which was excavated for the most part to "ledge" or "seamy rock". Grouting of the bedrock has not been documented and it is not believed that any form of foundation treatment was carried out. The left abutment is founded on a rock outcrop promontory which separates the dam from the spillway. Sketch plans and profiles of the dam and appurtenant structures are delineated on Fig. 1, Sheet 1, Appendix D.

2. Spillway

The spillway for East Lake Dam is located at a natural saddle and draw about 300 ft. to the left of the left abutment of the dam. The draw is separated from the main stream valley by an intervening hill and rock outcrop and empties into the East Lake Brook about 1,300 ft. below the dam.

The spillway approach channel is an unlined canal about 60 ft. wide excavated to elevation 681, the normal storage level in the reservoir. A 2-ft. wide concrete sill 62 ft. long at elevation 681 acts as a control for spillway releases. The sill is situated about 100 ft. upstream from the extended axis of the dam. Downstream from the sill, the riprapped channel falls at about a 5 percent grade.

The crest of the dam accommodates a local road which crosses the spillway channel via a bridge constructed about 100 ft. downstream from the control sill. This bridge appears to be of more recent construction and probably replaces an older bridge. The present bridge is of shorter span than that shown on an old sketch for the original design and considerably restricts the waterway area for carrying larger spillway discharges. The span of the bridge is about 15 ft. The invert of the waterway under the bridge is paved with a concrete lining. Converging approach walls are provided to the waterway under the bridge. Details of the spillway and bridge are delineated on Figure 1, Sheet D-1, Appendix D.

3. Outlets

The reservoir outlet is located near the center of the dam near the low point of the valley. The outlet is a 16 in. dia. pipe, presumably of cast iron, placed through the dam and continued with a 12 in. dia. pipeline in buried trench to Margerie Reservoir to the east. A 16 in. dia. blowoff valve is provided to permit releases to the brook downstream. The intakes to the outlet pipe are submerged, with no controls at the inlets. It is understood that from the 16 in. dia. pipe, an 8 in. line extends upstream from the dam, and inlets are provided at the toe of the dam and farther upstream in the reservoir.

Another outlet pipe and downstream 12 in. dia. valve are located at the left abutment of the dam at about elevation 670, or about 20 ft. above the valley level. This outlet is now in disuse, as is the bypass blowoff from the 16 in. dia. outlet pipe at the valley level. The inlet of the higher level outlet pipe is submerged and details of the entrance are not known. It is not known whether the 12 in. dia. valve is operable.

c. Size Classification

The East Lake Reservoir Dam is about 36 ft. high, impounding a maximum storage of about 1,000 acre-ft. to spillway crest level and about 1,400 acre-ft. to top of the dam. In accordance with the size and capacity criteria given in Recommended Guidelines for Safety Inspection of Dams, storage governs and therefore the project is classified as intermediate in size.

d. Hazard Classification

A breach failure of East Lake Reservoir Dam would release water down to Padanarum Brook and thence into Still River, which traverses the City of Danbury. At least 20 homes, a number of roadside commercial establishments, part of the Abbott Technical School and Route 37 could be affected by a flood depth of the order of 15 ft. South of Interstate Route 85, it is probable that more densely populated areas of Danbury would also be affected.

It therefore appears that a sudden breach of the dam would probably cause some loss of life and appreciable economic loss. Consequently, East Lake Reservoir Dam has been classified as having high hazard potential in accordance with the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership

The East Lake Reservoir Dam is owned by the City of Danbury.

f. Operator

Mr. Ralph Welch
Superintendent of Public Utilities
Danbury City Hall
155 Deer Street
Danbury, CT 06810

Telephone: (203) 797-4537

g. Purpose of Dam

The East Lake Reservoir is operated in conjunction with Margerie Lake Reservoir and other water storage facilities, for providing municipal water supplies to the City of Danbury.

h. Design and Construction History

Very little data has been found on the design or construction of the original dam at East Lake. Sketches from the City's files (Appendix B) indicate that a W. B. Rider was an engineer on the job during construction and possibly at the time when raising the dam was proposed. No other documentation on design or construction has been recovered.

i. Normal Operating Procedure

There are no written operating procedures. Operators are on duty around the clock at the filter plant below Margerie Lake Reservoir Dam, and are available to periodically regulate the withdrawals from East Lake storage and to check the reservoir conditions. The outlet gate at East Lake Reservoir is set at a fixed opening and operation is not a day-to-day procedure.

1.3 Pertinent Data

a. Drainage Area

The drainage area contributing to East Lake Reservoir encompasses about 1.49 square miles, draining the upper reach of East Lake Brook and an unnamed tributary to the west. The reservoir is at normal level elevation 681; Titicus Mountain on the west rim of the area rises to an elevation of 1023; the east rim of the area which forms a common divide with the Margerie Lake drainage area is at about elevation 830.

The drainage area measures about 1.5 miles long and an average of about 1 mile wide. The stream course has an average grade of about 2.4 percent, or about 130 ft. per mile.

The area to the east and north of East Lake Reservoir is relatively open land, heavily populated with several housing developments. The western portion of the area is forested.

b. Discharge at Damsite

1. Outlet Works

Release of stored waters at East Lake Dam is provided through a 16 in. dia. outlet pipe through the dam. The entrance to this pipe is through an 8 in. dia. pipeline laid along the reservoir bottom. The outlet pipe is connected to a 12 in. dia. pipeline which is carried to Margerie Reservoir. A blowoff from this pipe is provided at the toe of East Lake Dam. The size of the blowoff valve is 16 in. dia. The release capacity of the blowoff, with reservoir at normal storage level, is estimated at about 25 cfs. (See computations on Sheet D-15.)

2. Maximum Flood at Damsite

No records are available of flood inflows into East Lake Reservoir, nor of spillway releases and surcharge heads during such inflows.

3. Ungated Spillway Capacity at Top of Dam

The spillway at East Lake Reservoir is an ungated channel with concrete sill control measuring 62 ft. in length at elevation 681. About 100 ft. downstream from the control sill, a 15 ft. span highway bridge crosses the spillway outlet channel, such that a constriction in the waterway is formed in the spillway chute. For lower heads over the spillway sill, control will be at the spillway crest. For higher discharges, the control will shift to the bridge waterway downstream and backwater will drown out the spillway control. Were it not for the downstream bridge constriction, the spillway could handle about 2,700 cfs. with reservoir level to the top of the dam, elevation 686.1. Because of the bridge, it is estimated that the spillway capacity is only about 1,400 cfs. at that reservoir level. Discharge curves and computations are shown on Figure 2 and Sheets D-2 to D-5, Appendix D.

4. Ungated Spillway Capacity at Test Flood Elevation

The spillway capacity at a test flood elevation of 687.8 is 1,750 cfs.

5. Total Project Discharge at Test Flood Elevation

   The total discharge at the test flood elevation of 687.8 is 6,050 cfs.

c. Elevation (ft. above MSL)

   1. Top of dam - 686.1
   2. Maximum pool - top of dam - 686.1
   3. Spillway crest - 681.0
   4. Diversion tunnel - none
   5. Streambed at centerline of dam - 650

d. Reservoir

   1. Length of pool - 2,600 ft.
   2. Average width of pool - 1,200 ft.

e. Storages (acre-feet)

   1. Spillway crest - 993
   2. Top of dam - 1,400

f. Reservoir Surface (acres)

   1. Spillway crest - 71
   2. Test flood pool - 90
   3. Top of dam - 85

g. Dam

   1. Type - Puddle and dry earthfill embankment
   2. Length - 550 ft.
   3. Height - 36 ft.
   4. Top width - 15 ft. (top widened to accommodate 20 ft. roadway)
   5. Side slopes - 2 to 1 upstream; 1½ and 2 to 1 downstream
   6. Zoning - Concrete core wall, puddle fill upstream, dry embankment downstream
   7. Impervious core - Concrete core wall to bedrock; core wall carried to 6 ft. below top of dam
   8. Cutoff - Core wall in trench excavated up to 4 ft. below ground surface
   9. Grout curtain - None

h. Spillway

   1. Type - Unlined channel
   2. Length of weir - 62 ft.
   3. Crest elevation - 681.0
   4. Ungated

5. Upstream channel - Unlined in natural saddle, partly in rock, 50 ft. long
6. Downstream channel - Unlined, partly in rock, riprapped; 60 ft. bottom width on 5% slope
7. General - Downstream channel waterway restricted at highway bridge crossing. Backwater drowns out spillway crest at higher discharges.

i. Regulating Outlets

1. Invert - Elev. 650
2. Size - 16 in. dia. pipe with 16 in. dia. blowoff valve
3. and 4. Description - 16 in. dia. pipe through dam connected to 12 in. dia. line leading to Margerie Reservoir. 16 in. dia. blowoff valve at toe of dam.

SECTION 2 - ENGINEERING DATA

2.1 Design

Except for several rough sketches of the dam cross section and profile, no layout drawing or design data have been recovered. In 1967 the City of Danbury had topographic mapping prepared, including the East Lake Reservoir area, by photogrammetric methods, at 100 ft. to the in., which delineates the location and elevations of the dam and spillway. In the course of the inspection, measurements were also taken of the structures and a plan and profile layout was prepared. This sketch plan is shown on Figure 1, Sheet D-1, Appendix D.

2.2 Construction

No construction reports or histories of construction have been found. According to a plaque on the small gate structure near the left abutment, the dam was built in 1885-86.

2.3 Operation

The reservoir is operated by personnel of the City of Danbury, Department of Public Utilities. There appear to be no formal records.

2.4 Evaluation

a. Availability

Since no engineering data is available, it is not possible to make an assessment of the safety of the embankment. The basis of the information presented in this report is principally the visual observations of the inspection team.

b. Adequacy

Without any engineering data, a definitive review and assessment of this dam is impossible. The evaluation is based primarily on visual inspection and engineering judgment.

c. Validity

Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of East Lake Reservoir Dam took place on 9 and 14 November 1978. The dam appears to be in a generally fair condition. The steep portions of both upstream and downstream slopes, where the embankment has been widened to accommodate the roadway, are sloughing and sliding. Persistent seepage is apparent in two areas below the dam. The downstream slope is becoming overgrown and there are evidences of infestation by burrowing animals.

At the time of the inspection, the reservoir was at about elevation 677.6, or about 3.4 ft. below spillway crest level. It was not determined whether storage was being released through the pipeline to Margerie Lake Reservoir.

b. Dam

The general horizontal alignment of the embankment appears to be good. The upstream slope is heavily riprapped up to about 3 ft. from the top, above which it is exposed earth, with a certain amount of overgrowth. The unriprapped portion of the slope appears to be very steep, and in several places it is almost vertical, appearing about ready to fail. In some locations it is apparent that the earth supporting the highway on the upstream side is sloughing slowly towards the reservoir; as much as a 2 ft. differential is apparent between the gutter and the crown of the road.

The downstream slope of the dam is also very steep at the top and it would seem that the highway has been raised and widened without a corresponding fattening of this slope. Within the west third of the dam, for example, longitudinal cracks are evident in the surface of the road indicative of sloughing. There is also as much as 2-3 ft. differential between gutter and crown on the downstream side. The tilting of the guard rail posts associated with slope sliding is illustrated in Photo No. 1 (Appendix C).

At the toe of the dam about in its center, there is a masonry block valve chamber. Some 25 ft. downstream of this structure, there is a blowoff valve, beyond which a 16 in. dia. pipe emerges from a rough rubble headwall. The pipe issues into a marshy area in which standing water is apparent, covered with algae and leaves (Appendix C, Photo No. 2). With the water surface about 4 in. from the top of the pipe, it could not be determined whether the blowoff valve is leaking. The left and right sides of the outlet stream issuing from this stagnant zone are heavily bouldered and rocky. The stream flow appeared to be about 1 gpm. At the immediate left of the masonry block chamber, the ground is also quite marshy and boggy, indicating persistent seepage.

While some attempts have evidently been made to clear the downstream slope of overgrowth, these efforts should be expanded, since encroachment is becoming severe (Photo No. 2).

There are evidences of infestation by burrowing animals on the downstream face approximately 100 ft. from the left abutment, 10 ft. down from the top, and in another location 120 ft. from the abutment and 15 ft. down. On the downstream side of the left abutment, there is a small valve structure, on which is fixed a construction plaque. About 30 ft. downstream from this structure, at the toe, another large area of standing water is apparent, although no flow is evident anywhere along its boundaries. It is probable that this zone is seepage derived from the dam, but the very heavy vegetation and leaf cover precluded defining its origins.

c. Appurtenant Structures

Except for small shrub and weed growths, the spillway channel is relatively free of vegetation (Appendix C, Photo Nos. 3, 4 & 5). The channel sides appear stable; and although it is not now apparent because of weathering, it is believed that much of the channel was excavated in rock. Riprap in the channel bottom below the control crest appears to be in place.

Sketches of the original construction show a 48 ft. wide, 3 span waterway below a road bridge crossing downstream from the spillway crest. The present bridge with a waterway width of about 15 ft. appears to be a later reconstruction. The constriction in the spillway channel brought about by this narrowed waterway will reduce the discharge capacity of the spillway, as described in Section 1.3 b.

The inlet of the outlet pipe was submerged and could not be seen at the time of the inspection. The pipe from the dam to Margerie Lake is buried and could not be observed. The valve houses for the 16 in. dia. and 12 in. dia. outlet pipes are of ashlar masonry and are overgrown with vegetation and difficult to inspect. The valves at these structures were not operated and their condition could not be ascertained in detail.

d. Reservoir Area

The reservoir shoreline and slopes upstream from the dam on both left and right abutments are stable with no evidences of slides or sloughing. The slopes are very rocky and sparsely vegetated. Being in a restricted water supply preserve, no homes are constructed along the shoreline. There would be no damage to property owing to a rise within the surcharge and freeboard space of the reservoir.

e. Downstream Channel

East Lake Brook below the reservoir empties into Padanarum Reservoir, a small pond on the Padanarum Brook about ½ mile below the dam. Padanarum Brook continues in a narrow valley to its confluence with the Still River in North Danbury. Valley storage along the Padanarum Brook would be small and large outflows from East Lake spills would continue down the valley with but a slight reduction in the magnitude of flow. Many homes and commercial establishments are situated along State Highway 37 which follows Padanarum Brook, where new homes were being constructed near river level at the time of the inspection.

3.2 Evaluation

The visual inspection has adequately revealed key characteristics of the dam as they may relate to its stability and integrity. The dam and appurtenant works are judged to be in fair condition.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The East Lake Reservoir facility is operated by personnel of the Danbury Public Utilities Department, who are stationed at the filter plant about 1,000 ft. below the nearby Margerie Lake Dam. Reservoir operation entails mainly the release of stored water from the reservoir as water supply needs warrant. The outlet from the reservoir to the filter plant is a pressure pipe with valves at the outlet of the pipe, such that day-to-day regulation of the outlet valve is not required and, indeed, it appears to be left open permanently. No documented operating procedures have been prepared.

4.2 Maintenance of Dam

Little maintenance is required except for periodic cutting of brush growth on the embankments. No documented maintenance instructions have been prepared.

4.3 Maintenance of Operating Facilities

The valve operating mechanisms require periodic maintenance to keep them serviceable. The valve houses should be cleared of overgrowing vegetation and put into good repair.

4.4 Warning System

There is no formal warning system or program at this dam.

4.5 Evaluation

Although little is known about the construction of the facility, it has simple operating devices and, as such, requires no detailed operating procedures. Maintenance involves periodic growth removal from the embankment and surveillance regarding seeps, slope damage, animal burrows, etc. Outlet operating valves require checking for serviceability. A formal warning and emergency evacuation system should be developed.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

1. Reservoir Area and Capacity

For determining reservoir areas and capacities below normal storage level, a contour map prepared by the City of Danbury Engineering Division, Fig. 3, Sheet D-6, Appendix D, was planimetered and capacities were computed. For determining surface areas and surcharge capacities, planimetered areas were taken from contours delineated on USGS 2,000 ft. per in. quadrangle sheets. Area and capacity curves and tables, for use in flood routings, are shown on Sheets D-7 and D-8, Appendix D.

2. Flood Hydrology

The test flood chosen to evaluate the hydrologic and hydraulic capacity of East Lake Reservoir Dam was selected in accordance with the criteria presented in the Recommended Guidelines for Safety Inspection of Dams. Since this dam is classified as intermediate in size with a high hazard potential, a test flood of magnitude corresponding to the full Probable Maximum Flood was selected for the evaluation.

Precipitation data was obtained from Hydrometeorological Report No. 33, which for the Connecticut area approximates 24.3 in. of 6-hour point rainfall over a 10 square mile area. This value was then reduced by 20 percent to allow for basin size, shape and fit factors. The 6 hour rainfall-duration curve of a total of 19.2 in. was then redistributed and rearranged as suggested in Design of Small Dams. A constant loss factor of 0.1 in. per hour was deducted from the precipitation values to give the excess rainfall used to prepare an inflow hydrograph.

A triangular incremental unitgraph was assumed for the inflow hydrographs, using a computed lag time value of about 1 hour to derive a time-to-peak for the triangular hydrograph of 1 hour (see computations on Sheets D-9 and D-10, Appendix D). A PMF inflow hydrograph is shown on Fig. 4, Sheet D-11, Appendix D, indicating a peak inflow of about 6,900 cfs. or a CSM of about 4,600.

Flood routings were performed for two conditions of spillway capability: (1) on the basis of the spillway capacity as it presently exists, with control for larger flows at the downstream bridge restriction and with the spillway crest submerged; and (2) on the basis of the spillway capacity as it was initially designed, with the restriction wide enough for control to be at the spillway crest for all flows. Results of the routings are shown on Figures 5, 6 and 7 (Sheets D12-14) and are summarized as follows:

Flood Magnitude	Max. Disch. cfs	Max. Res.El. ft.MSL	Max. Head Over Dam ft.	Max. Disch. Over Dam cfs.	Max. Q/ft. Over Dam cfs.	Total Outflow Over Dam Ac-Ft	Duration Of Overtopping Of Dam hrs.
BRIDGE WATERWAY CONTROL							
Full PMF	6050	687.83	1.73	4250	7.7	522	3.2
0.75 PMF	3900	687.25	1.15	2300	4.2	231	2.4
0.50 PMF	1450	686.15	0.05	50	0.1	2	0.8
SPILLWAY CREST CONTROL							
Full PMF	5900	687.30	1.20	2000	3.6	205	2.2
0.75 PMF	4050	686.70	0.60	800	1.5	68	1.6
0.50 PMF	2400	685.55	(-0.55)	0	0	0	0

From the above table, it can be seen that the project cannot handle the test flood with the spillway capacity restricted by the downstream bridge. If the bridge waterway was modified to provide control for all releases at the spillway crest, it would still be inadequate to pass the test flood outflow. However, both the maximum discharge and the total outflow spilled over the dam for a full PMF event are about double the values which would occur if the bridge restriction was removed. For a 0.5 PMF, the surcharge capacity together with releases through either control will be sufficient to avoid an overtopping of the dam.

b. Experience Data

No records are available in regard to past operation of the reservoir, nor of surcharge encroachments and spills through the spillway. The maximum past inflows are unknown.

c. Visual Observations

There are no present evidences either along the reservoir or in the downstream channel to indicate high water levels or signs of major spillway outflows. No one contacted could recollect any such occurrences.

d. Overtopping Potential

For the test flood, an overtopping of about 1.73 ft. can occur over the dam. Such an overtopping would release a maximum of 4,250 cfs. over the 550 ft. length, or a unit discharge of about 7.7 cfs. per ft. A total of about 520 acre-ft. would flow over the dam during a 3.2 hour period.

It is to be noted that the dam has a core wall extending to bedrock across its entire length, with its top 6 ft. below the crest of the dam. If the crest was to erode owing to an overtopping, it would not be expected that a sudden failure for the entire height would occur, but rather that the failure would be slowed by the core wall. If a 100 ft. wide breach were to wash out down to the top of the core wall, a total discharge of about 6,100 cfs. could flow through that gap. This flow, together with spillway releases and overtopping of the remainder of the dam of about 5,400 cfs., would provide a total outflow of about 11,500 cfs.

e. Drawdown Capacity

Drawdown of the reservoir is possible through the 16 in. dia. low level outlet pipe blowoff and through the 12 in. dia. pipe at the left abutment. If it were deemed necessary to evacuate the reservoir through these outlets, and if the valves are operable, it is estimated that over 30 days would be required to empty the 1,000 acre-ft. of storage, assuming no inflow in the interim (see computations on Sheet D-15).

f. Downstream Hazard

As discussed in Para. d above, if erosion of a 100 ft. length of the crest of the dam during overtopping was to occur, a total outflow of about 11,500 cfs. could spill down Padanarum Brook. If a breach owing to structural failure of the dam, such as by piping or sloughing, was to occur, a breach similar to that from an overtopping could be assumed and the "rule of thumb" criteria

suggested in the NED March 1978 Guidance Report would be applicable. The reservoir level in this instance could be assumed to be lower than at the top of the dam. If the reservoir is assumed to be at normal storage level at the time of the breach, with no flow through the spillway, and a gap eroded to a 20 ft. bottom width with slopes on a 1¼ to 1 angle of repose, an outflow of up to about 18,500 cfs. could be released (see computations on Sheet D-15, Appendix D).

A number of homes and commercial establishments are located along Padanarum Brook and State Highway 37 traverses the valley near flood plain level. Stage-discharge computations at a river section downstream from this populated area show that a flood stage of up to 15 ft. could prevail for an 11,500 cfs. outflow from East Lake Reservoir, and up to an 18 ft. stage could occur for an 18,500 cfs. outflow (see computations on Sheet D-16). Since valley storage in this reach of Padanarum Brook is small, the flood wave would be only slightly diminished until it reached the Still River in Danbury. At least 25 homes, a number of roadside commercial establishments, part of the Abbot Technical School and Route 37 itself would be affected. It is probable that more densely populated areas of Danbury south of Interstate Route 84 would also be affected. During the inspection it was noted that foundations for a number of new homes in a housing development were being built practically at stream level on both banks of the stream along Highway 37 and Padanaram Road below the Margerie Lake Reservoir. These and any future new homes in the vicinity would also be affected. Delineated on Fig. 8 (Sheet D-17, Appendix D) are the areas which could be flooded by a breach failure of East Lake Dam, at a river stage for about 12,000 cfs.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation

The field investigations of the embankment revealed no significant displacement or distress which would warrant the preparation of slope stability computations based on assumed soil properties and engineering factors. While the dam is in fair condition, attention should be given to several deficiencies listed in Section 7.

b. Design and Construction Data

The construction plaque on the valve house at the left abutment indicates that the dam was constructed in 1885 and 1886.

An old sketch cross section of the dam, undated, by W. B. Rider, Engineer, shows proposed reconstruction to accommodate the 20 ft. wide roadway. The crest width then was 15 ft., and the geometrics of a proposed fill are shown to raise the dam 5 ft. In schematic outline, a solution using 1½ to 1 slope is shown to accommodate a 20 ft. roadway.

In view of the distress to the existing crest road, these workable geometrics do not seem to have been observed in the actual reconstruction.

c. Operating Records

There are no operating records of any significance to structural stability.

d. Post Construction Changes

The raising of the dam sometime after initial construction apparently did not follow conventional design practice, and has resulted in an inability to maintain satisfactory roadway geometrics. It has not, however, affected the structural stability of the embankment itself.

The highway bridge over the spillway channel appears of more recent construction and probably replaces an original bridge which had a much wider waterway. Although the

shorter spanned bridge has reduced spillway capacity, it has no direct effect on dam stability.

e. Seismic Stability

The dam is located in Seismic Zone No. 1, and, in accordance with Phase I guidelines, does not warrant seismic analyses.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

On the basis of the Phase I visual examination, the East Lake Reservoir Dam appears to be in fair condition and functioning adequately. The deficiencies revealed are not of major concern, but indicate that further investigations are required and that additional routine maintenance is also needed.

The serviceability of the outlet valve, which is apparently left open permanently, is doubtful, as is that of the blowoff valve on the low level outlet pipe. The high level outlet pipe at the left abutment is apparently disused and also of questionable serviceability. The crest of the dam has been widened to accommodate a 20 ft. roadway and the top parts of both slopes are unstable and sloughing down. There are marshy areas downstream of the dam in the vicinity of both outlets, apparently due to seepage derived from the reservoir. There is also some evidence of infestation by burrowing animals. The capacity of the spillway to pass flood outflows is restricted by a short span bridge across the outlet channel. The spillway capacity is inadequate to pass the test flood outflow without overtopping the dam, but would pass the outflow from a flood event of about 0.5 PMF.

b. Adequacy of Information

The information recovered is considered adequate for the purpose of making an assessment of the performance of the dam.

c. Urgency

The recommendations and remedial measures enumerated below should be implemented by the owner within one year after receipt of the Phase I Inspection Report.

d. Need for Additional Investigation

Additional investigations are required as recommended in Para. 7.2.

7.2 Recommendations

It is recommended that the owner should retain the services of a competent registered professional engineer to make investigations and studies, and, if proved necessary, design suitable remedial works for the following items:

1. Determine whether additional spillway capacity is required, and whether the bridge across the outlet channel should be lengthened or the outlet channel deepened.

2. Determine the source of apparent leakages at and downstream of the toe of the embankment in the vicinities of the 16 in. dia. main outlet and the 12 in. dia. left abutment outlet pipes.

3. Examine the configuration of the roadway on the crest of the dam and provide for its adequate support by the dam embankment.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

   1. Growth on the slopes and at the downstream toe of the dam should be removed and controlled on a regular basis.

   2. Seepage zones should be isolated and monitored monthly during periods of high reservoir level, and at least once a year, for changes in seepage volume and turbidity. Seepage zones noted are in the vicinity of the main outlet valve house and from 25-50 ft. downstream, and in the area at the toe of the left abutment.

   3. Rodent infestation of the embankment should be controlled.

   4. At the main outlet, the outlet pipe valve and bypass valve should be inspected both for operability and leakage. The 12 in. dia. outlet valve at the left abutment should also be inspected. All valves found to require repair should be restored to a serviceable condition.

5. A formal surveillance and flood warning plan should be developed. An operational procedure to follow in the event of an emergency should also be adopted.

6. Procedures for a biennial periodic technical inspection of the dam and appurtenant works should be instituted.

7.4 Alternatives

The only alternatives to those discussed in Para. 7.2 are: (1) to raise the dam; (2) to maintain the reservoir at a lower level than the present normal elevation; and (3) to breach the dam and abandon the reservoir as a water source.

APPENDIX A

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION
PHASE I

Identification No. CT 00066 Name of Dam: East Lake Reservoir Dam

Dates of Inspection: 9 & 14 November 1978

Weather: Cloudy, Cool Temperature: 50°F±

Pool Elevation at Time of Inspection: 678 MSL ±

Tailwater Elevation at Time of Inspection: Not applicable

INSPECTION PERSONNEL

Pasquale E. Corsetti	Louis Berger & Associates, Inc.	Acting Proj. Manager
Carl J. Hoffman	Louis Berger & Associates, Inc.	Hydraulics, Structures
Thomas C. Chapter	Louis Berger & Associates, Inc.	Hydrology, Soils
James H. Reynolds	Goldberg Zoino Dunnicliff & Associates, Inc.	Soils

OWNER'S REPRESENTATIVES

Ralph Welch	City of Danbury	Superintendent of Public Utilities
Bruce Haley	City of Danbury	Chief Operator, Filter Plant

VISUAL INSPECTION CHECKLIST

Identification No: CT 00066 | Name of Dam: East Lake Reservoir | Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
EMBANKMENT Vertical alignment and movement	Alignment good; some settlement of crest road at left abutment, other locations.
Horizontal alignment and movement	Alignment good; no movement evident.
Unusual movement or cracking at or near the toe	None evident.
Surface cracks	Road surface cracked.
Animal burrows and tree growth	Burrows 10 ft. and 15 ft. down d/s slope 100 ft. right of left abutment. Brush growth on both slopes.
Sloughing or erosion of slopes	Slopes too steep at roadway edges; sides sloughing 2-3 ft. maximum; guardrail posts tilted.
Riprap slope protection	Good condition.

VISUAL INSPECTION CHECKLIST

Identification No: CT 00066 | Name of Dam: East Lake Reservoir | Sheet 2

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
Seepage	Marshy, boggy area in vicinity of main outlet gatehouse and 25-50 ft. d/s; at toe of left abutment.
Piping or boils	None evident.
Junction of embankment and abutment, spillway and dam	No problems evident.
Foundation drainage	None.
OUTLET WORKS Approach channel	None.
Outlet conduit concrete surfaces	None.
Intake structure	None visible.
Outlet structure	None (buried 12 in. dia. pipe)

VISUAL INSPECTION CHECKLIST

Identification No: CT 00066 Name of Dam: East Lake Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
Outlet channel	Natural stream.
Drawdown facilities	16 in. dia. blowoff valve, condition doubtful.
SPILLWAY STRUCTURES Concrete weir	2 ft. wide concrete sill in rock channel, condition good.
Approach channel	Cut in rock, riprap floor in good condition, some light growth.
Discharge channel	Cut in rock and natural, some light growth and boulders.
Stilling basin	None.
Bridge and piers	15 ft. span concrete slab on masonry piers 100 ft. downstream from sill (waterway restricted).
Control gates and operating machinery	None.

VISUAL INSPECTION CHECKLIST

Identification No: CT 00066 | Name of Dam: East Lake Reservoir | Sheet 4

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
INSTRUMENTATION Headwater and tailwater gages	None.
Embankment instrumentation	None.
Other instrumentation	None.
RESERVOIR Shoreline	Gentle slopes, stable, heavily wooded.
Sedimentation	None evident.
Upstream hazard areas in event of backflooding	None.
Alterations to watershed affecting runoff	None noted.

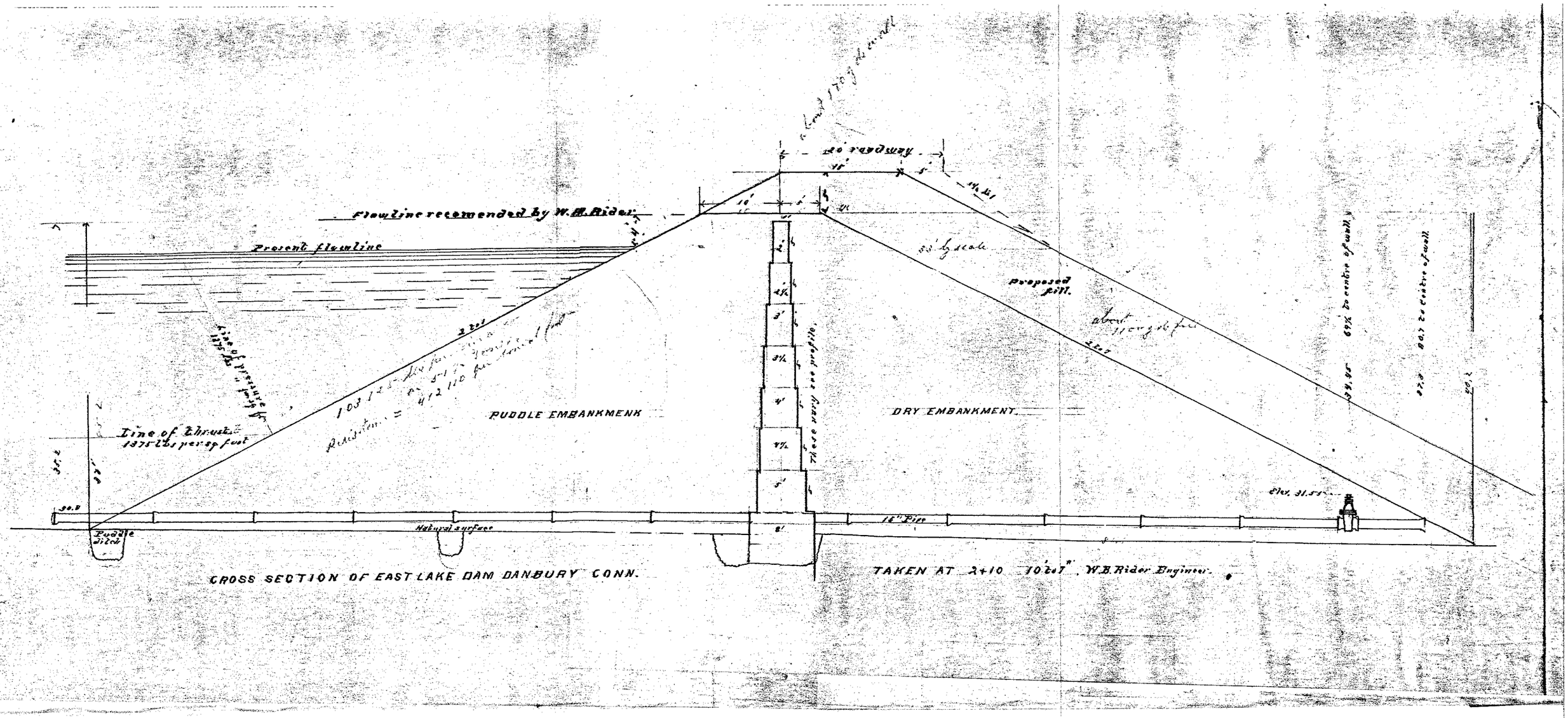
VISUAL INSPECTION CHECKLIST

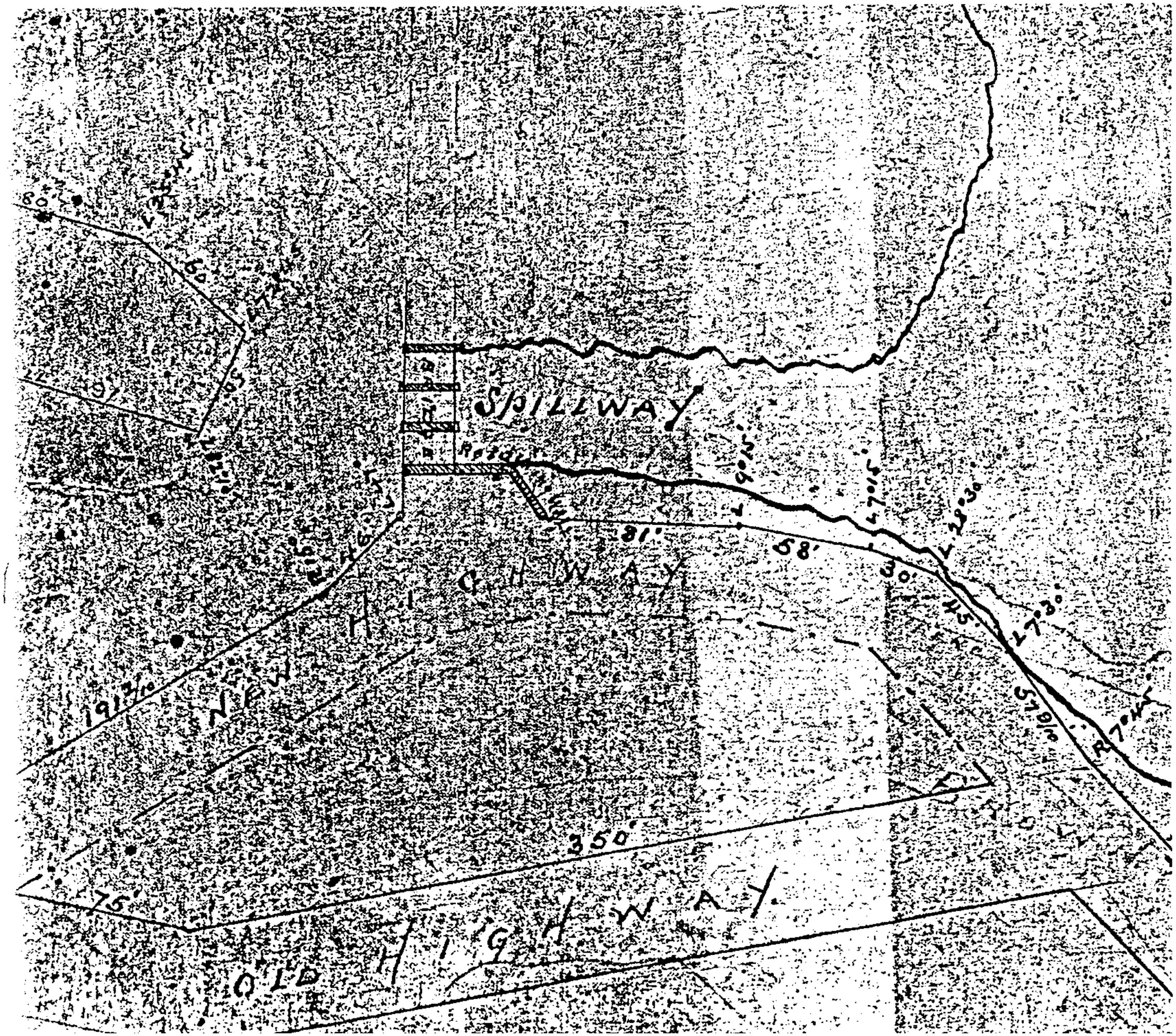
Identification No: CT 00066 | Name of Dam: East Lake Reservoir | Sheet 5

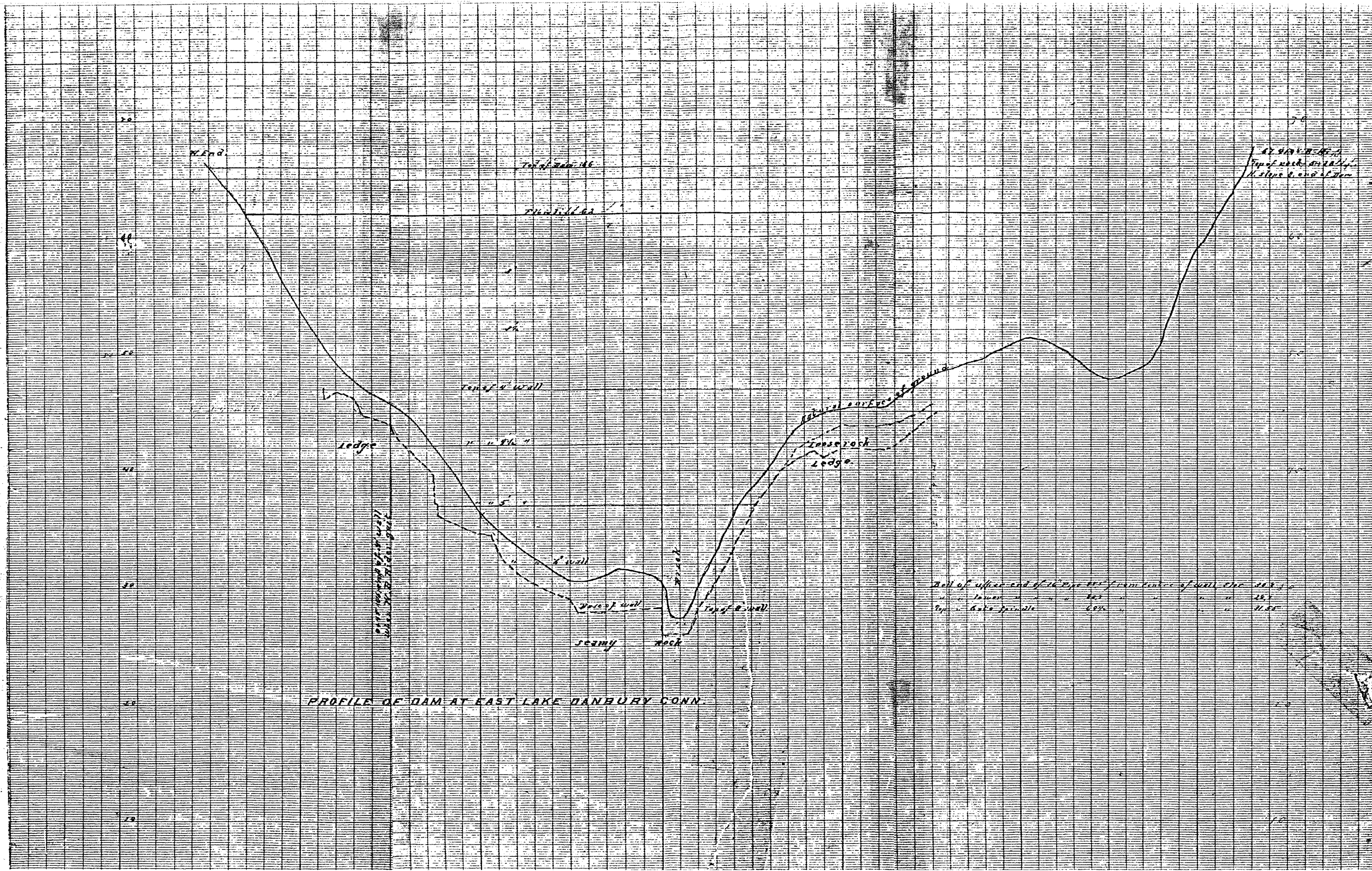
VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
DOWNSTREAM CHANNEL Constraints on operation of dam	None.
Valley section	Narrow, heavily wooded.
Slopes	Steep.
Approx. No. of homes/population	At least 20 homes and several commercial establishments along Padanarum Rd. New homes under construction on banks of Padanarum Brook.
OPERATION & MAINTENANCE FEATURES Reservoir regulation plan, normal conditions	No formal plan. Water released as required to Margerie Lake Reservoir.
Reservoir regulation plan, emergency conditions	None.
Maintenance features	Brush cut periodically.

APPENDIX B

PLANS & RECORDS


Flowline recommended by W.B.Rider.
Present flowline
20' roadway
Proposed fill.
about 11 cu.yds per foot
2 to 1
1½ to 1
30' by scale
PUDDLE EMBANKMENK
DRY EMBANKMENT
Line of Thrust 1375 lbs per sq foot
Natural surface
Puddle ditch
16" Pipe
Elev. 31.55
CROSS SECTION OF EAST LAKE DAM DANBURY CONN.
TAKEN AT 2+10 10 feet W.B.Rider Engineer.

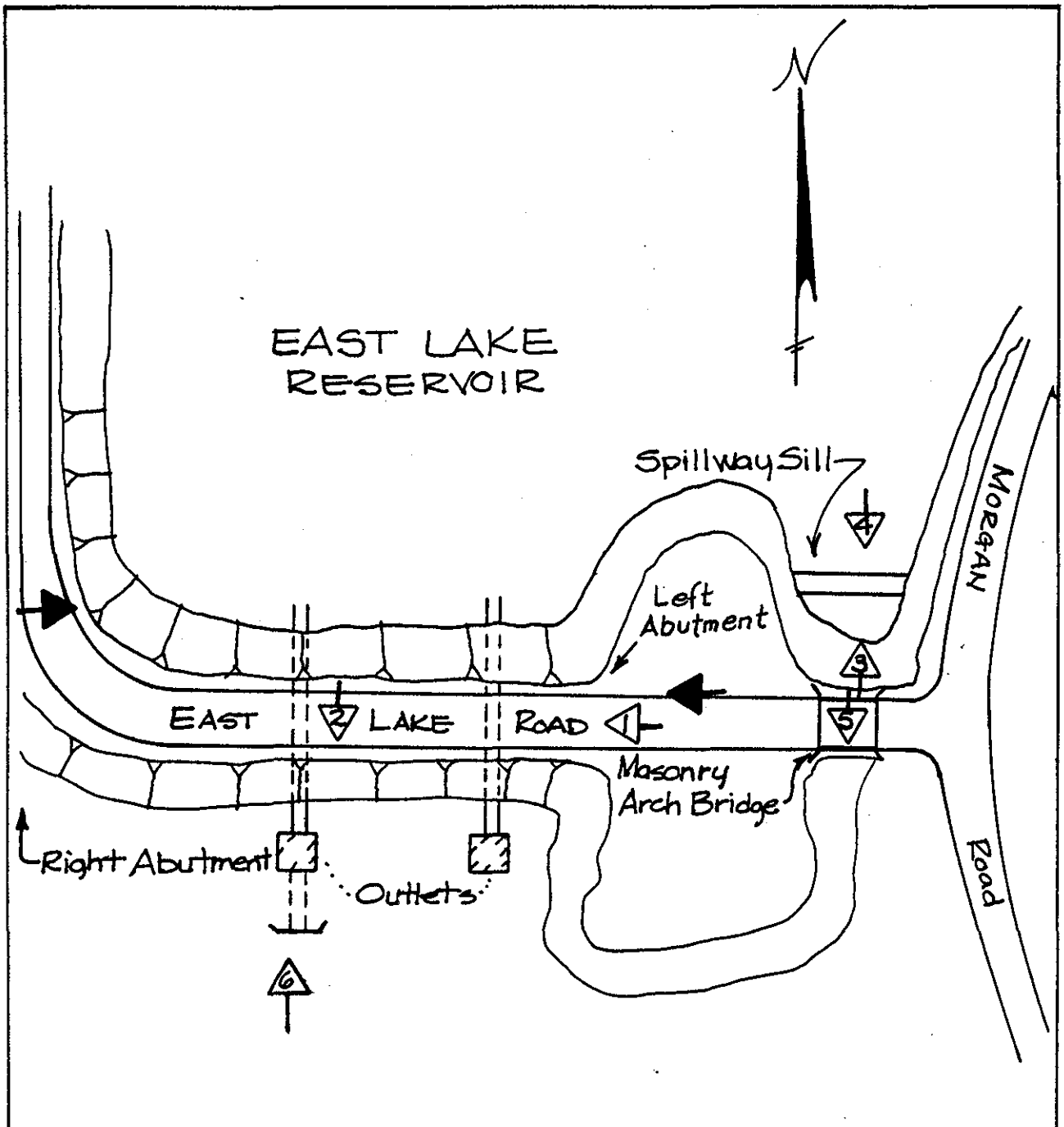

SPILLWAY
NEW HIGHWAY
OLD HIGHWAY
81'
58'
30'
350'
75'



PROFILE OF DAM AT EAST LAKE DANBURY CONN.

APPENDIX C

SELECTED PHOTOGRAPHS



Overview Photos

Appendix "C" Photos

LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

EAST LAKE RESERVOIR DAM

SKETCH PLAN SHOWING LOCATION & ORIENTATION OF PHOTOS

STATE - CT.

			SCALE 1:24000
			DATE

EAST LAKE RESERVOIR DAM

1. Downstream slope from left abutment

2. Main outlet channel from top of dam

EAST LAKE RESERVOIR DAM

3. Spillway sill and discharge channel, looking towards reservoir

4. Spillway sill and discharge channel looking downstream, showing bridge

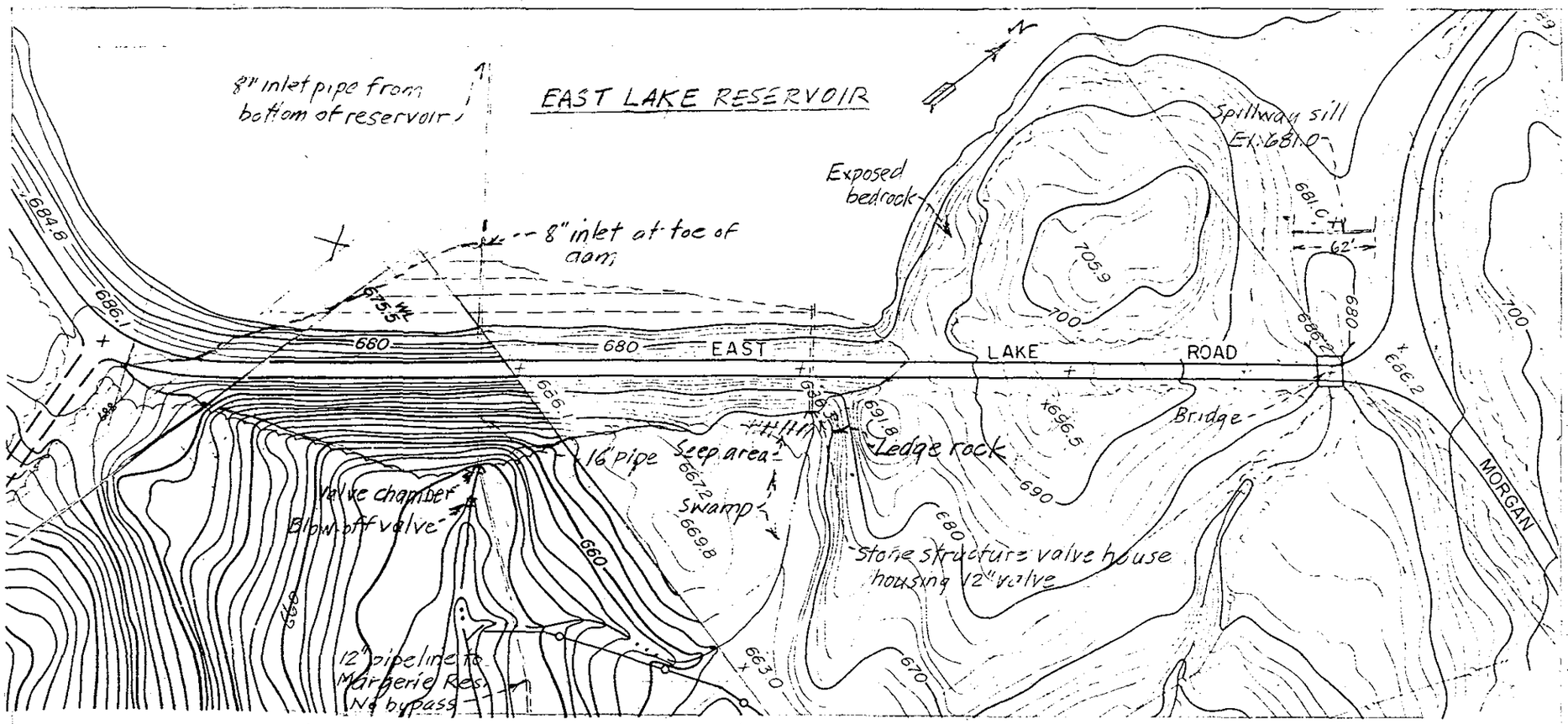
EAST LAKE RESERVOIR DAM

5. Spillway discharge channel looking downstream from bridge crossing

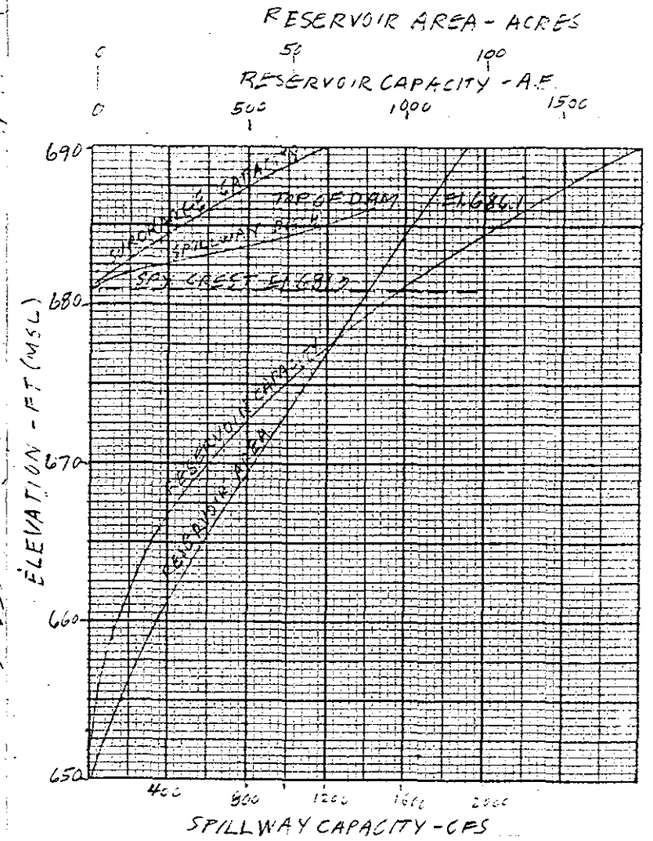
6. 16 in. dia. blowoff pipe and valve house for 12 in. dia. outlet pipe to Margerie Lake

APPENDIX D

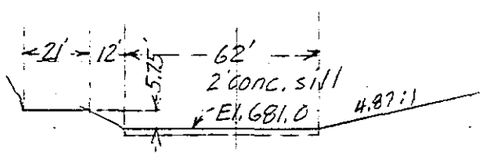
HYDROLOGIC & HYDRAULIC COMPUTATIONS



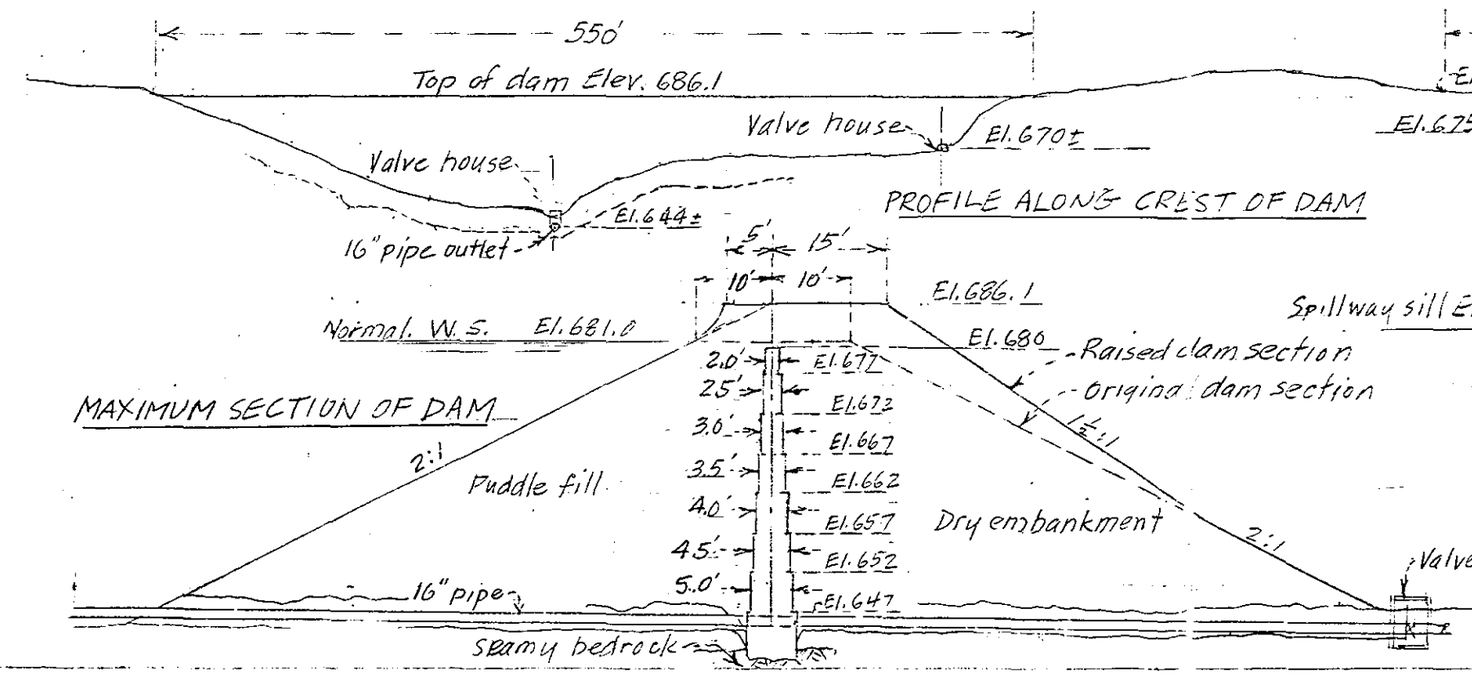
PLAN

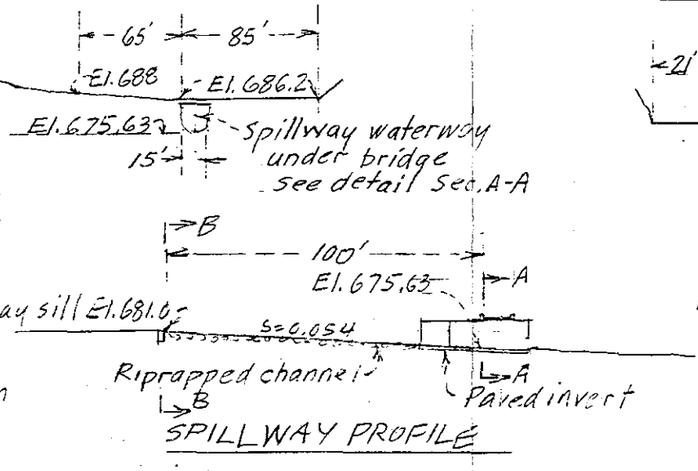


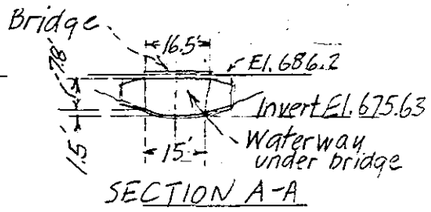
AREA-CAPACITY CURVES



SECTION B-B





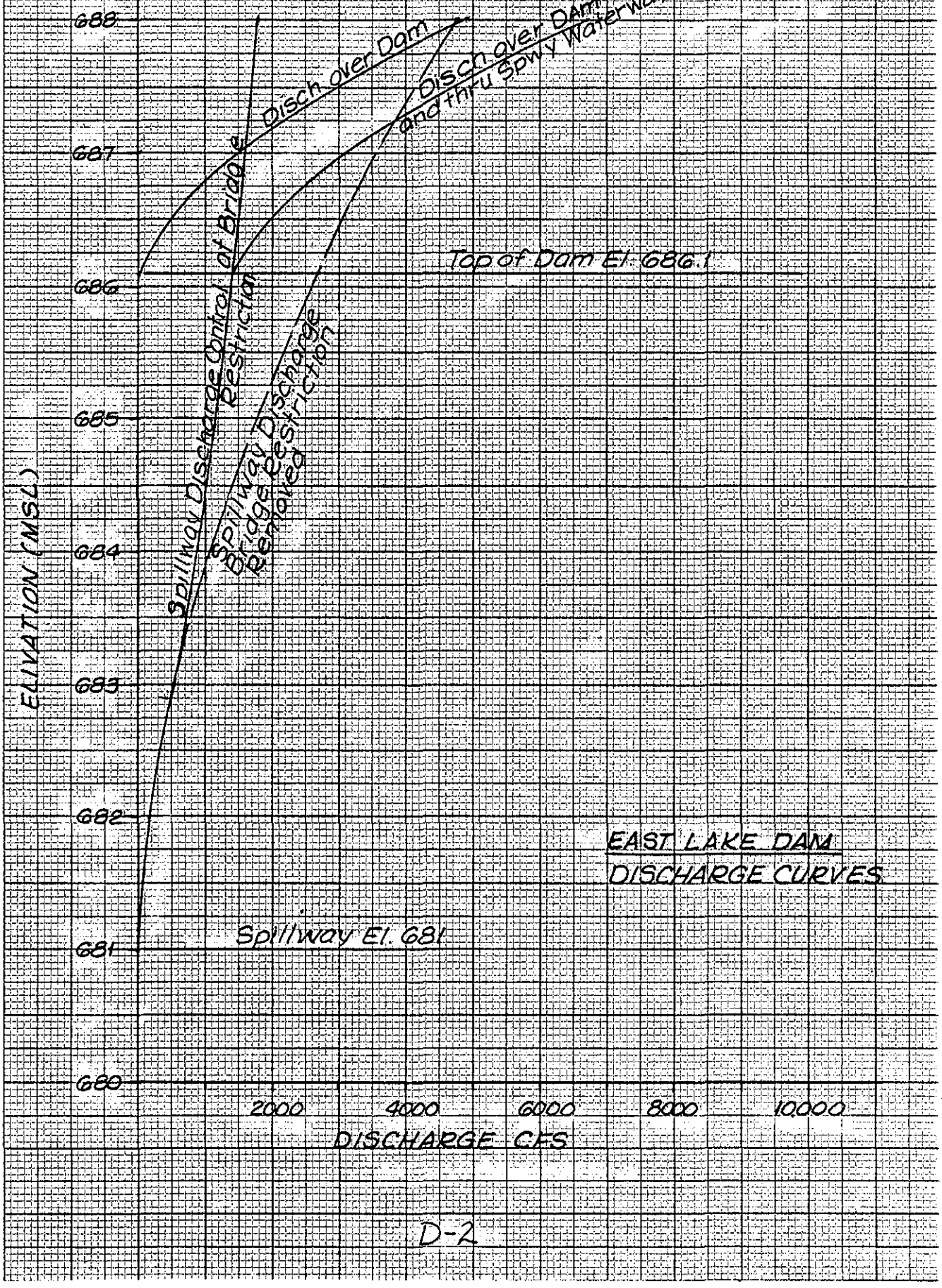


SECTION A-A

CITY OF DANBURY
EAST LAKE RESERVOIR DAM
PLAN AND SECTIONS

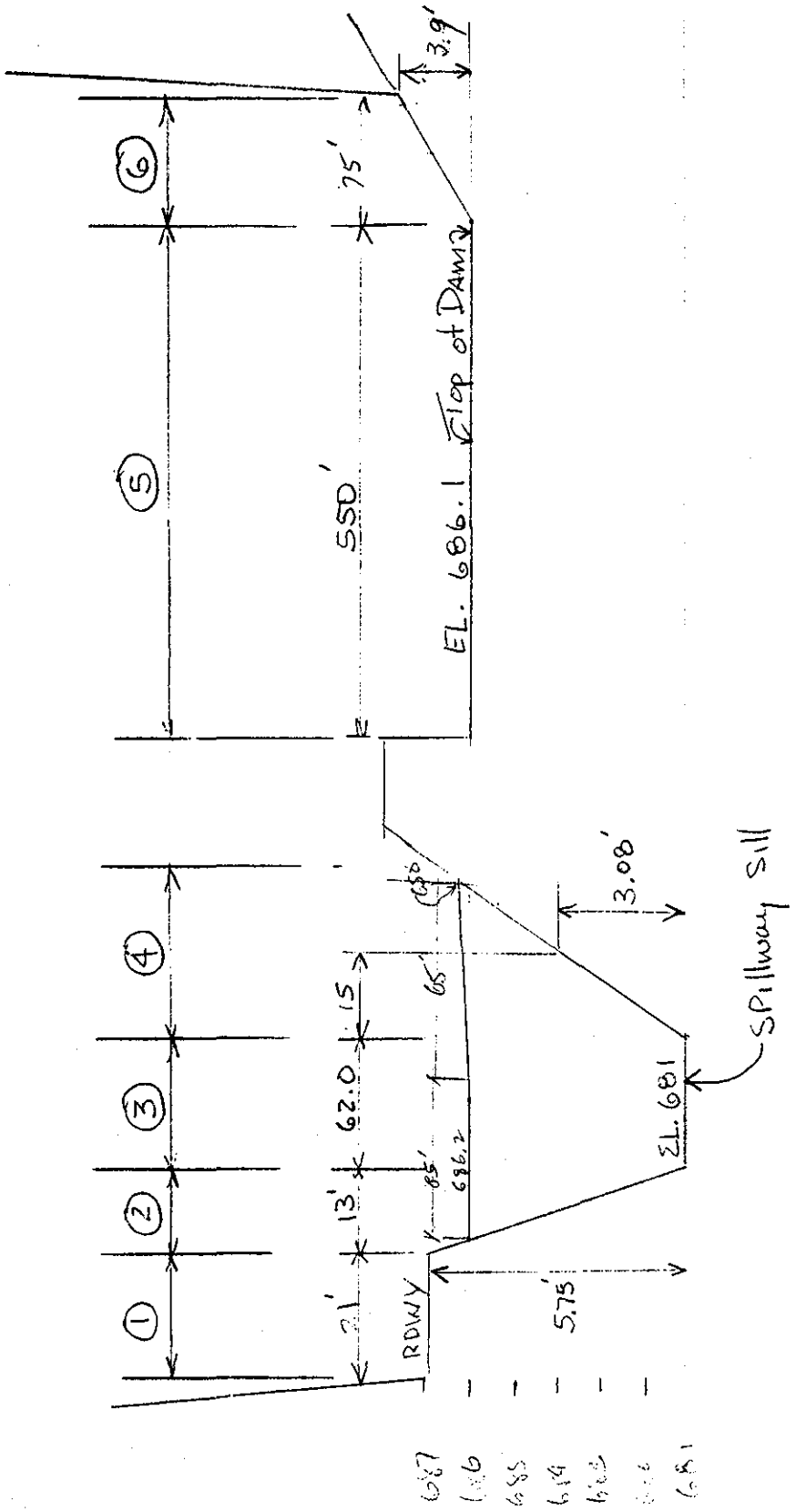
D-1

FIG. 2 SHT D-2



EAST LAKE DAM
DISCHARGE CURVES

DISCHARGE CURVES - SPILLWAY CREST AND DAM OVERTOPPING



PROFILE OF SPILLWAY AND DAM CREST
(HORZ. NOT TO SCALE)

D-4

← SPILLWAY DISCHARGE

ELEV	Sec. 3 L=62' H	C	Width	Q/ft	ΔQ	Sec. 2 Average H	L	ΔQ	Sec. 1 L=21 H	C	ΔQ	SECTION 4 Ave Q/ft	L	ΔQ	ΣQ Spillway
681.0	0	2.8		0	0			0				0		0	0
682.0	1	2.81	62	2.81	174	1.40	2.26	3				1.40	4.87	7	184
683.0	2	2.83	62	8.00	496	4.00	4.57	18				4.00	9.74	39	553
684.0	3	2.85	62	14.61	918	7.41	6.78	50				7.41	14.61	108	900 ~~1076~~
685.0	4	2.87	62	22.96	1424	11.98	9.04	108				11.98	19.48	233	1160 ~~1765~~
686.1	5.1	2.9	62	33.40	2071	16.70	11.53	192				16.70	24.84	414	1400 2677
686.75	5.75	2.9	62	39.78	2479	19.99	13.0	260	0	-	0	17.79	28.00	560	1550 ~~3299~~
687.0	6.0	2.9	62	42.62	2642	21.49	13.0	279	.25	2.8	7	21.31	29.32	623	1600 3558
688.0	7.0	2.9	62	53.79	3330	28.81	13.0	375	1.25	2.6	82	26.85	34.91	915	1770 ~~4702~~

Bridge constriction removed

ELEV	SEC 5 L=55 H	C	Q/ft	ΔQ	Ave Q/ft	L	ΔQ	ΣQ Dam
686.1	0	2.8	0	0	0	0	0	0
686.75	.65	2.8	1.47	808	0.73	12.5	9	817
687	0.90	2.8	2.39	1315	1.20	17.3	21	1336
688	1.90	2.8	7.33	4032	3.66	36.6	134	4166

SPILLWAY ROAD OVERTOPPING L=65

Elev	H	C	Q/ft	ΔQ	Ave Q/ft	L	1.8 65 ΔQ	ΣQ
686.2	0			0	-			0
686.75	0.55	2.8	1.14	97	0.57	19.9	11	108
687	0.80	2.8	2.00	170	1.00	29.9	29	199
688	1.80	2.8	6.76	575	3.38	65.0	220	795

TOTAL Discharge

Elev	Spillway	Dam	Total
681	0	and Road	0
682	184		184
683	553		553
684	~~1076~~ 900		900
685	~~1765~~ 1160		1160
686.1	2677 1400	0	1400 Top of dam
686.75	~~3299~~ 1550	925	2475
687.0	3558 1600	1535	3135
688.0	4702 1770	4961	6731

SPILLWAY CREST CONTROL

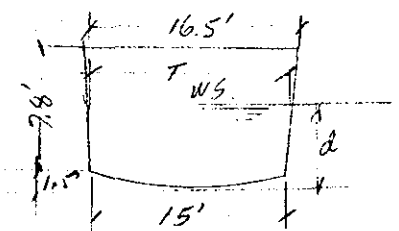
Bridge waterway control

Total discharge Bridge waterway control and dam overtopping

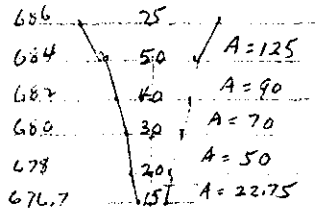
BY DJH DATE 1-4-78 | LOUIS BERGER & ASSOCIATES INC. | SHEET NO. D-5 OF...

CHKD. BY ... DATE ... | PROJECT ...

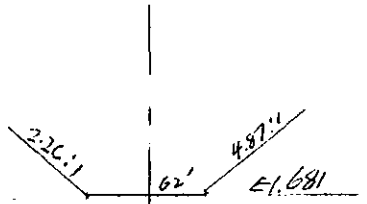
SUBJECT EAST LAKE RESERVOIR DAM - SPILLWAY DISCHARGE CURVE



Waterway under bridge
Sta 1+00

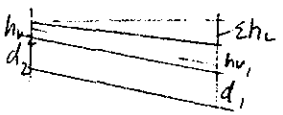


Upstream from bridge
Sta 0+80



At spillway crest
Sta 0+00

$n = 0.0225$



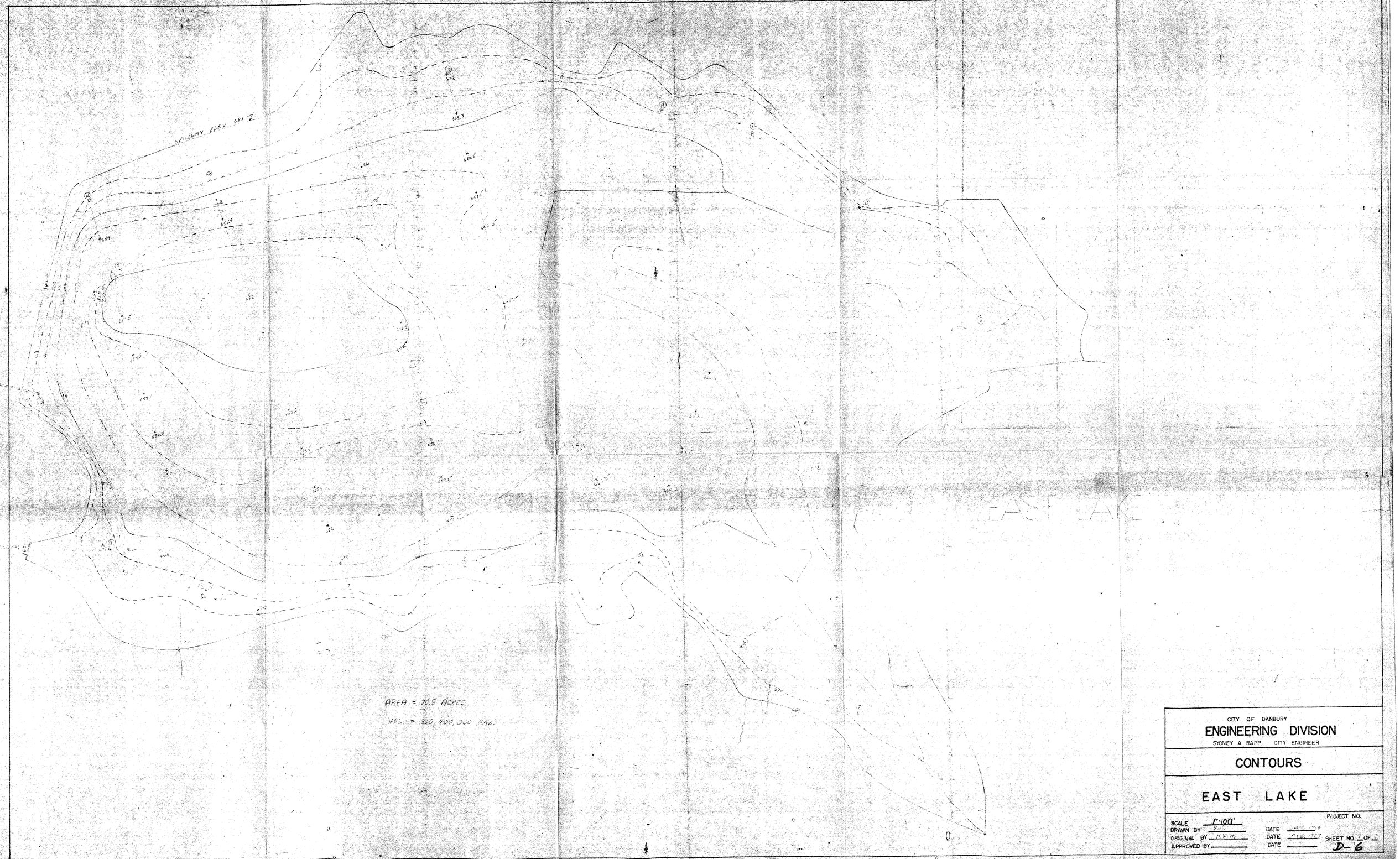
Bridge waterway - Sta 1+00 ← Critical flow — Upstream from bridge Sta 0+80 →

d	T	A	h_{vc}	v_c	Qc	Gradient = d + h_{vc} + invert	Wetted perimeter	r	$r^{2/3}$	$S_f = \left(\frac{Qn}{1.49Ar^{2/3}}\right)^2$	d	WS El.	A	v	h_v	w.p.	r	$r^{2/3}$	S	Aver. S	SL	$0.2h_1$	Σh_c	Gradient $_2$
2.0	15.10	22.52	0.75	6.93	156	678.38	17	1.32	1.21	.0075	1.6	678.3	35.20	4.43	0.30	21.5	1.64	1.39	.0023	.0049	0.10	0.15	0.25	678.63
4.0	15.40	53.10	1.72	10.51	558	681.35	20	2.66	1.92	.0069	4.8	681.5	123.38	4.52	0.32	42.26	2.92	2.04	.0011	.0040	0.08	0.34	0.42	681.77
6.0	15.87	84.45	2.66	13.09	1105	684.29	24	3.52	2.31	.0074	7.9	684.6	265.0	4.17	0.27	60.34	4.39	2.68	.00052	.0040	0.08	0.53	0.61	684.90
8.0	16.25	116.56	3.59	15.20	1771	687.22	28	4.16	2.59	.0081	11.0	687.7	497.7	3.54	0.20	95.08	5.25	3.02	.00032	.0042	0.08	0.72	0.80	688.02

At spwy crest Sta 0+00

Q	Trial d	WS El	A	v	h_v	Trial Gradient	w.p	r	$r^{2/3}$	S	Aver. S	SL	Gradient	Remarks
156	0.60	681.60	38.46	4.05	0.26	681.86	66.3	0.58	0.70	.0077	.0063	0.50	679.13	Control is at crest @ Res El 681.93
558	2.00	683.0	138.25	4.04	0.25	683.25	76.89	1.80	1.48	.0017	.0014	0.11	681.88	Control is at crest @ Res El. 683.18
1105	3.70	684.70	278.2	3.97	0.25	684.95	89.4	3.21	2.18	.00076	.0006	0.05	684.95	ok
1771	6.80	687.80	586.4	3.02	0.14	687.94	112.35	5.21	3.00	.00023	.0028	0.02	688.04	ok

D-5



CITY OF DANBURY
ENGINEERING DIVISION
SYDNEY A. RAPP CITY ENGINEER

CONTOURS

EAST LAKE

SCALE 1"=100'
DRAWN BY D.J.C. DATE Sept. 29
ORIGINAL BY M.P.M. DATE Feb. 27
APPROVED BY _____ DATE _____
PROJECT NO.
SHEET NO. 1 OF 1
D-6

PEC DATE 12/12/78 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. D-7 OF

KD. BY DATE DAM INSPEC PROJECT W189

BJECT EAST LAKE DAM

AREA - CAPACITY CURVES

Elev	Area acres	AV. AREA acres	H +	Δ STOR	Σ STOR	Surcharge stor AC-F
650	0					
655	8	4	5	20	20	
660	17.5	12.8	5	64	84	
665	29	23.25	5	116	200	
670	42	35.5	5	177	377	
675	54	48	5	240	617	
680	68.5	61.25	5	306	923	
681	70.8	69.65	1	70	993	0
682	73.5	72.15	1	72	1066	72
683	76.3	74.9	1	75	1140	147
684	79.0	77.65	1	78	1218	228
685	81.7	80.35	1	80	1298	305
686	84.5	83.10	1	83	1381	388
687	87.3	85.90	1	86	1467	474
688	90.1	88.70	1	89	1556	563
690	95.5	92.80	2	186	1742	749

FIG 3 SHT D-8

EAST LAKE DAM
RESERVOIR AREA-CAPACITY CURVE

D-5

KEUFFEL & ESSER CO.
MADE IN U.S.A.

K+E STANDARD ® CROSS SECTION
10 X 10 TO THE HALF INCH

EAST LAKE DAM:

DRAINAGE AREA = 955 acres
RESERVOIR AREA = 61.5 acres

OVERLAND RUNOFF = 893.5 acres or 1.4 sq. mi

$L = 4.7 \text{ inches} \times 2000 \text{ ft/in} \times \frac{1 \text{ mi}}{5280 \text{ ft}} = 1.78 \text{ mi}$

H = Elev. 910 - Elev. 681 = 229 feet

S = 229 feet / 1.78 mi = 129 ft/mi or 2.4%

assume $L_c = L/2$

Then:

$$\text{LagTime} = K\left(\frac{L \times L_c}{\sqrt{S}}\right)^{.33} = K\left(\frac{1.78 \times 1.78/2}{\sqrt{129}}\right)^{.33}$$

$$= .52K$$

Assume K = 2.0 Curve "A"

LagTime = .52(2.0) = 1.04

DETERMINE T_p;

$T_p = 0.82(\text{LagTime}) + 0.41 D$ Assume D = 0.5 hrs

$T_p = 0.82(1.04) + 0.41(0.5)$

$T_p = 1.06$ Say 1.00

Check velocity - 150' / 2.0'

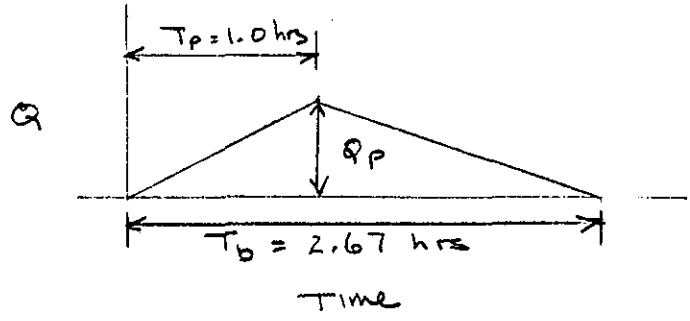
For 5' depth A = 187.5 r = 2.5 n = 0.100

$V = \frac{1.486}{n} r^{2/3} S^{1/2} = \frac{1.486}{.100} \times 1.84 \times .02^{1/2} = 4.27$ ft/sec < 3 ft/sec per Manning's Tables

$T_c = \frac{1.78 \times 5280}{4.27 \times 3600} = 0.61$ hrs $T_p = \frac{D}{2} + 0.6 T_c = 0.61$ hr < 1.0

D-9

Develop UNIT GRAPH:

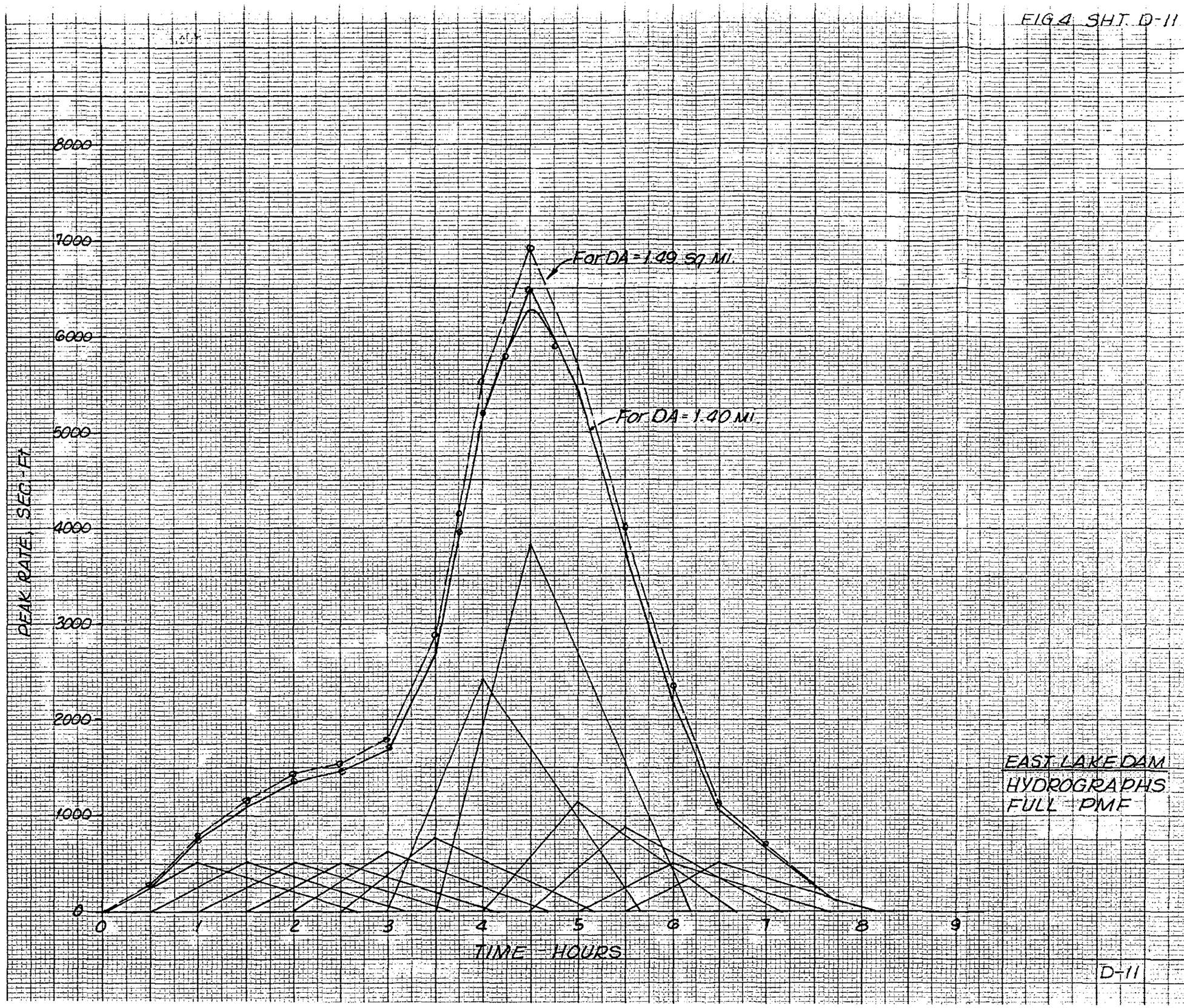


$$Q_p = \frac{484\,AQ}{T_p} = \frac{484\,(1.47)\,(1.4)\,(1.0)}{1.0} = 678.\text{cfs} \quad (721.2)$$

Rainfall:
PMP = 24" × 0.8 (fit factor) = 19.2" for 6 hrs.
19.2 − 0.4 (Filtration loss) = 18.8"

TIME	RAIN. DIST (in)	Qp	Begin T	T of PEAK	T of END
0					
0.5	0.75	509	0	1.0	2.67
1.0	0.75	509	0.5	1.5	3.17
1.5	0.75	509	1.0	2.0	3.67
2.0	0.75	509	1.5	2.5	4.17
2.5	0.94	637	2.0	3.0	4.67
3.0	1.13	766	2.5	3.5	5.17
3.5	3.57	2420	3.0	4.0	5.67
4.0	5.64	3824	3.5	4.5	6.17
4.5	1.69	1145	4.0	5.0	6.67
5.0	1.32	895	4.5	5.5	7.17
5.5	0.75	509	5.0	6.0	7.67
6.0	0.75	509	5.5	6.5	8.17

*Note: These are values for 1.4 sq. mi area
For 1.49 sq. mi area multiply by 1.064



EAST LAKE DAM
HYDROGRAPHS
FULL PMF

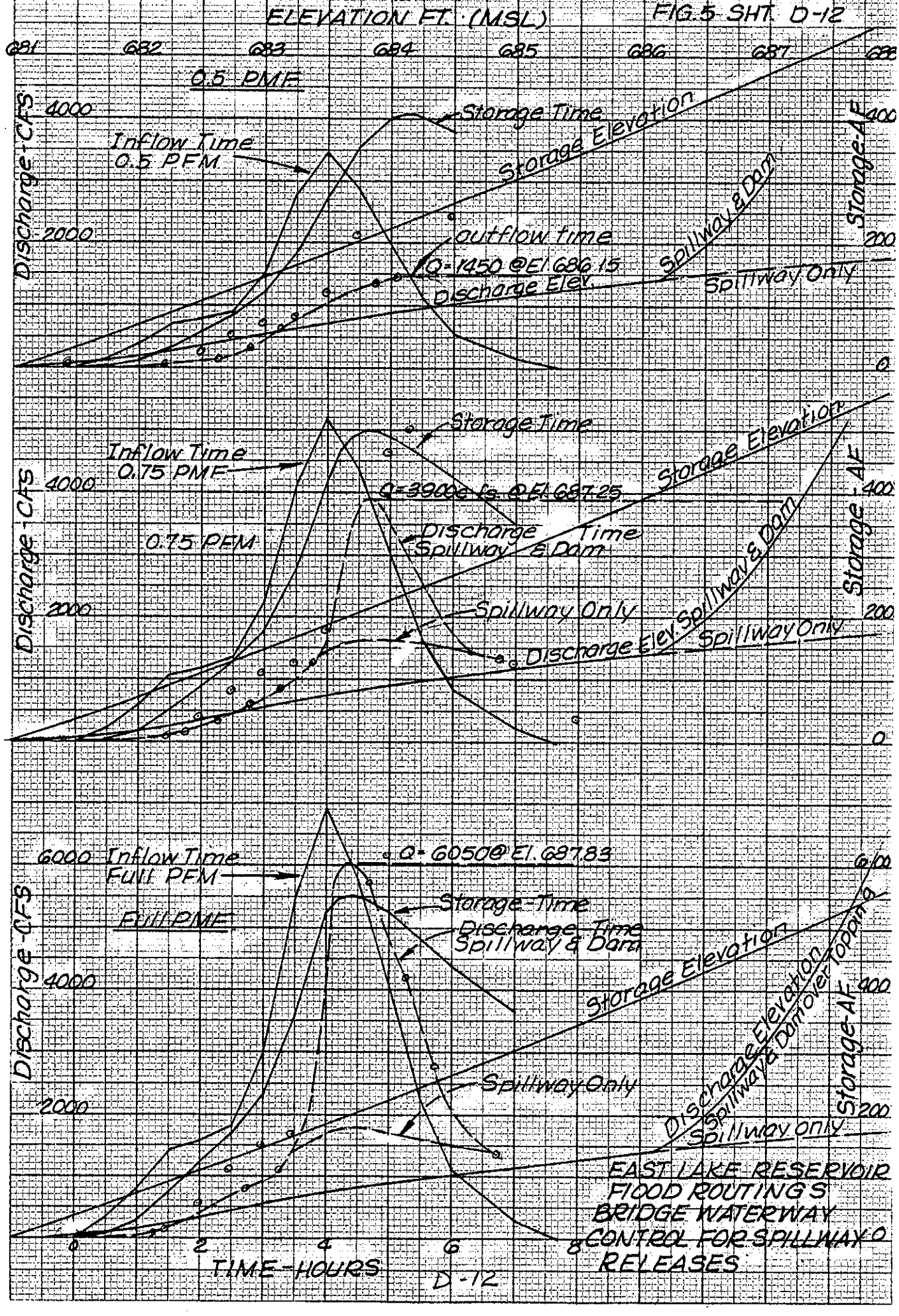

ELEVATION FT. (MSL)
FIG 5 SHT D-12
681
682
683
684
685
686
687
0.5 PMF
Discharge-CFS
4000
2000
Inflow Time
0.5 PFM
Storage Time
Storage Elevation
outflow time
Q=1450 @El 686.15
Spillway & Dam
Discharge Elev.
Spillway Only
Storage-AF
400
200
0
0.75 PFM
Inflow Time
0.75 PMF
Storage Time
Q=3900 cfs @El 687.25
Storage Elevation
Discharge Time
Spillway & Dam
Spillway Only
Discharge Elev.
Spillway & Dam
Spillway Only
Full PFM
6000
Inflow Time
Full PFM
Q=6050 @El. 687.83
Storage Time
Discharge Time
Spillway & Dam
Storage Elevation
Discharge Elevation
Spillway & Dam over Top of Dam
Spillway Only
Spillway only
2
4
6
8
TIME-HOURS
EAST LAKE RESERVOIR
FLOOD ROUTINGS
BRIDGE WATERWAY
CONTROL FOR SPILLWAY O
RELEASES
D-12

FIG. 6 SHT. D-13

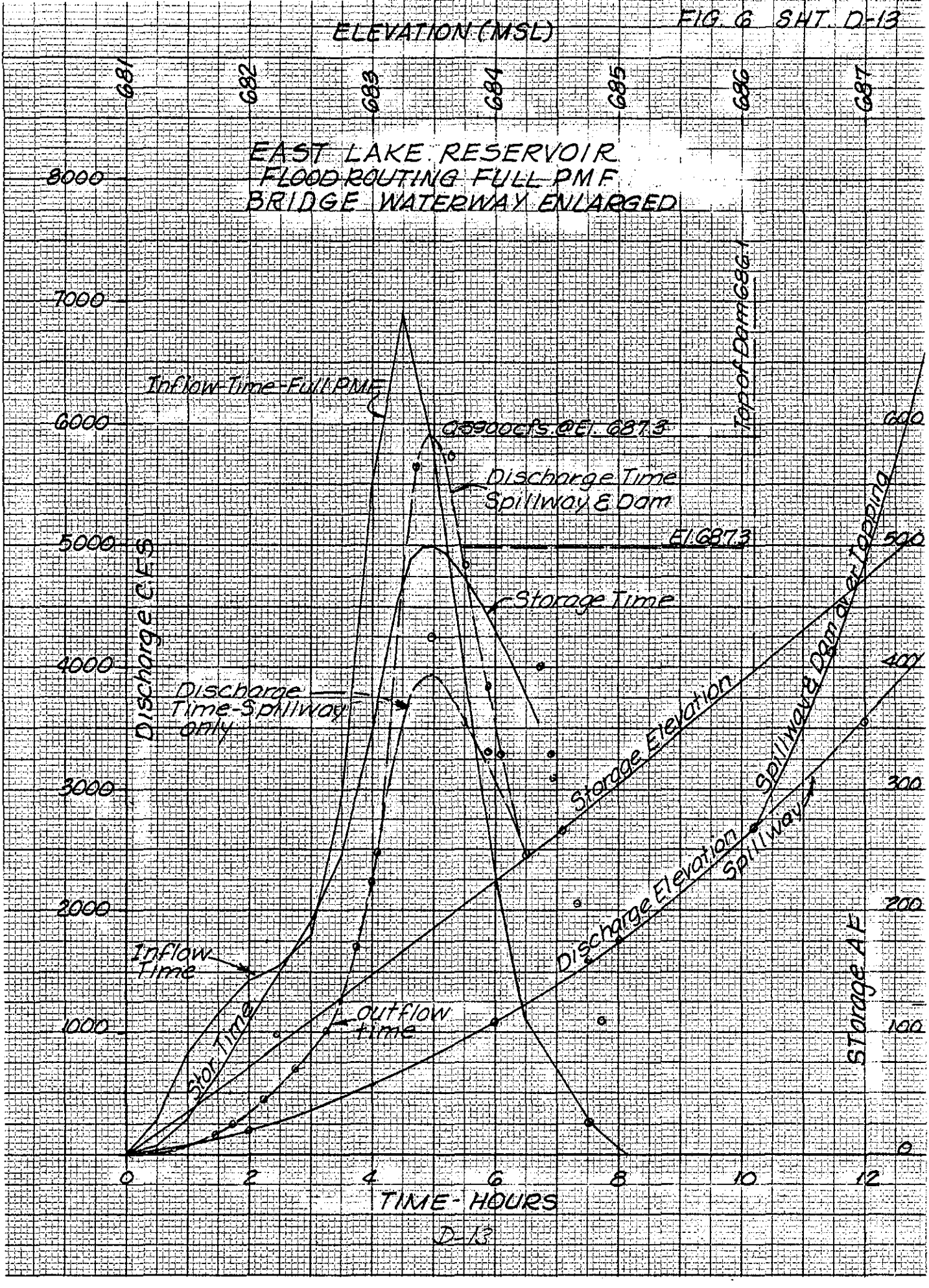
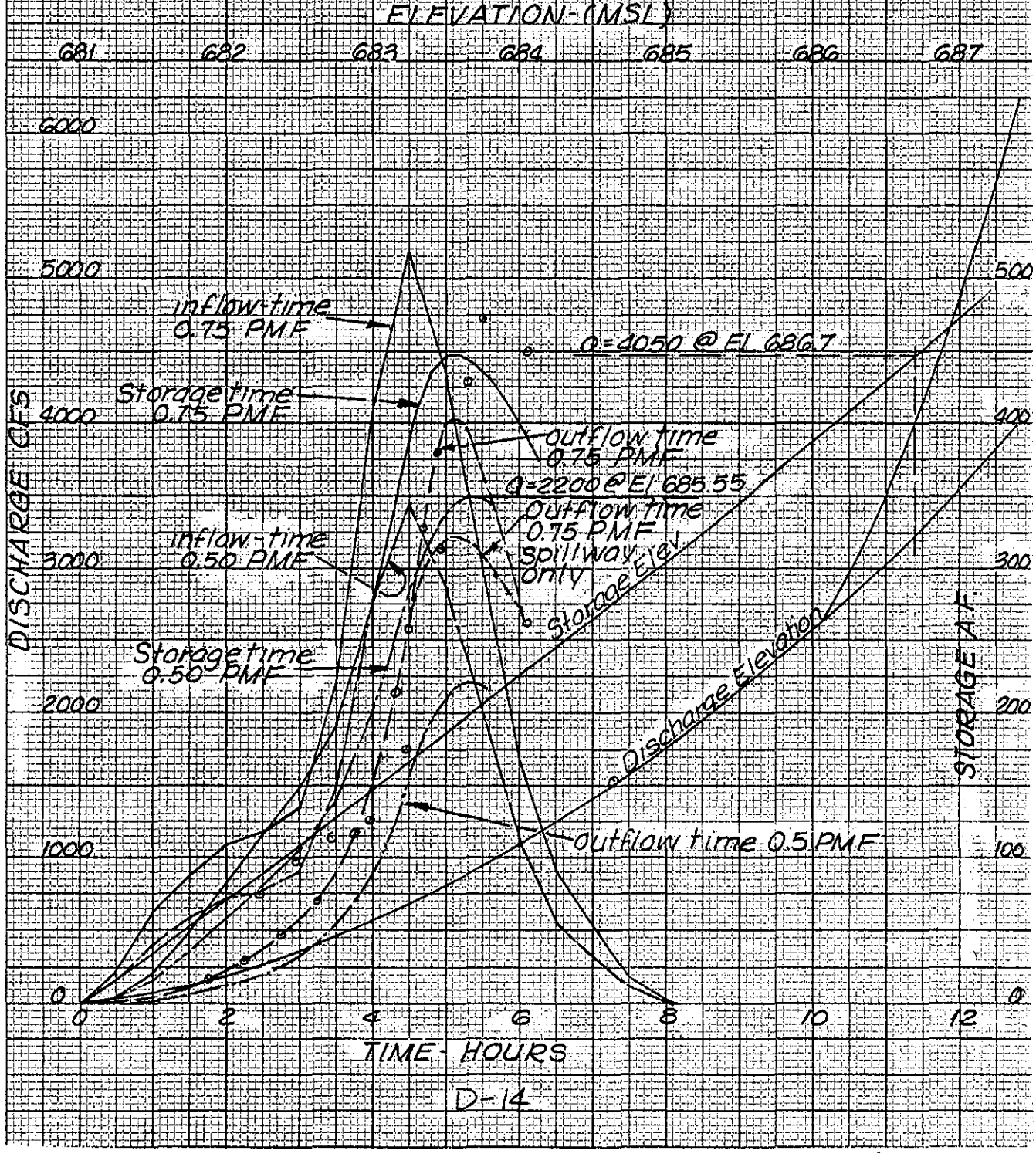

ELEVATION (MSL)
681
682
683
684
685
686
687
EAST LAKE RESERVOIR
FLOOD ROUTING FULL PMF
BRIDGE WATERWAY ENLARGED
8000
7000
6000
5000
4000
3000
2000
1000
0
Discharge C.F.S.
Inflow Time-Full PMF
Q5900cfs. @El. 6873
Discharge Time Spillway & Dam
El 6873
Storage Time
Discharge Time-Spillway only
Inflow Time
Stor Time
Outflow time
Storage Elevation
Discharge Elevation
Spillway & Dam overtopping
Spillway
Top of Dam 688.1
600
500
400
300
200
100
0
Storage A.F.
0
2
4
6
8
10
12
TIME - HOURS
D-13

FIG 7 SHT D-14

EAST LAKE RESERVOIR
FLOOD ROUTINGS - 0.75 PMF AND 0.5 PMF
BRIDGE WATERWAY ENLARGED



D-14

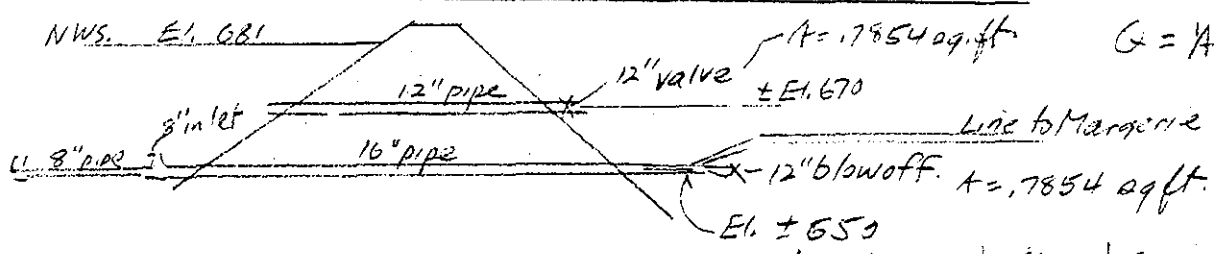
KEUFFEL & ESSER CO. MADE IN U.S.A.

BY QH DATE 1-6-78 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. D-15 OF...

CHKD. BY...DATE... INSPECTION OF DAMS-CONN'T RI PROJECT...

SUBJECT EAST LAKE DAM -

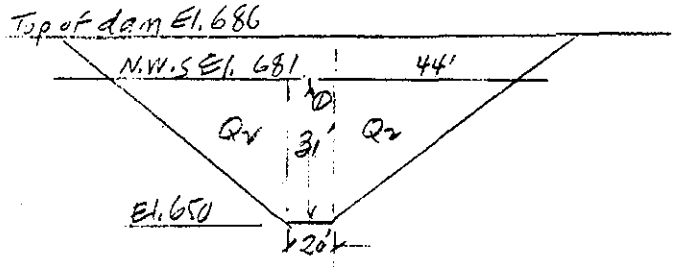
EVACUATION TIME OF RESERVOIR THRU OUTLETS



$Q = A\sqrt{\frac{2gH}{\Sigma k}}$

	Low level outlet			High level outlet			Total Q	Average Q	Δ Storage	Evacuation Time days
Res. El.	H	Σk	Q cfs	H	Σk	Q				
681	31	6	24	11	5	10	34			
672	22	6	16	2	5	4	20	27	540	10
660	10	6	8				8	14	360	13
652		-	4				4	6	100	8
								Total		31 days

BREACH FAILURE OF DAM.



$Q_1 = 1.68 \times 20 \times 31.^{3/2} = 5800$ cfs

$Q_2 = 1.68 \times \frac{44 \times 2 \times 31^{3/2}}{2} = 12760$

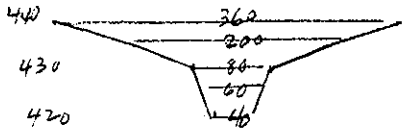
$18,560$ cfs.

ESTIMATE OF STAGE-DISCHARGE IN PADANARUM BROOK

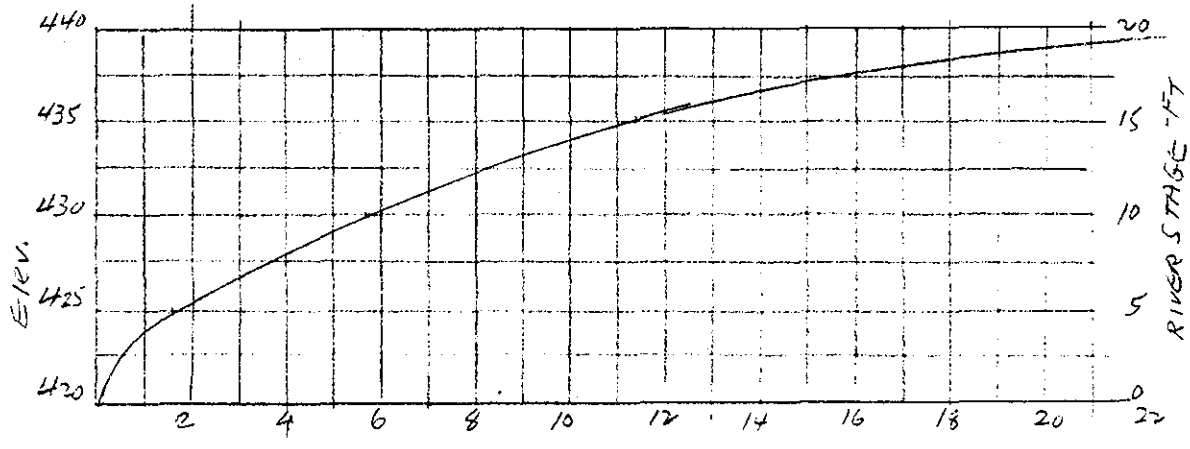
AT RIVER THALWEG ELEV. 420 (Downstream from residential & comm; area

RIVER SLOPE 10' in 600' = 0.0167

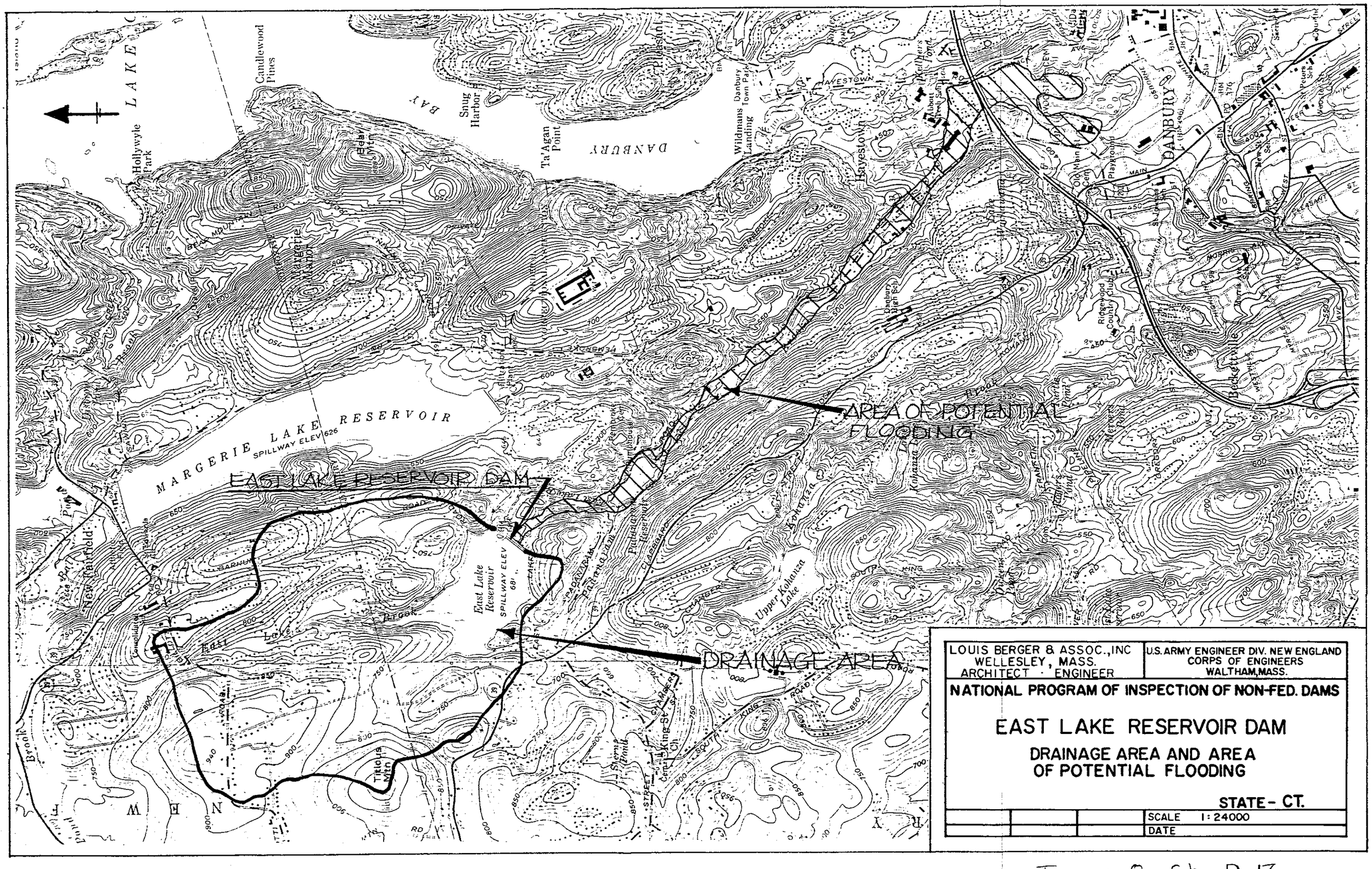
$S^{1/2} = 0.129$ $n = 0.075$ $Q = \frac{1.486}{n} A r^{2/3} S^{1/2} = 19.8 A r^{2/3} S^{1/2}$



Elev.	d	width	Average width	Δ Area	Σ Area	Wetted perim	r	$r^{2/3}$	Q
420	0	40			0				0
425	5	60	50	250	250	62.4	4.0	2.52	1610
430	10	80	70	350	600	84.8	7.07	3.69	5650
435	15	200	140	700	1300	205.2	6.34	3.42	11370
440	20	360	280	1400	2700	365.5	7.39	3.79	26160



STAGE - DISCHARGE IN PADANARUM BROOK
AT THALWEG ELEV. 420



LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

EAST LAKE RESERVOIR DAM

DRAINAGE AREA AND AREA OF POTENTIAL FLOODING

STATE - CT.

			SCALE 1:24000
			DATE

Figure 8, Sh. D-17

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY	MO	YR
CT	66	NED	CT	001	05				EAST LAKE RESERVOIR DAM	4126.4	7329.4	15	JAN	79

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	EAST LAKE RESERVOIR

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	07	EAST LAKE BROOK	DANBURY	3	51900

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(27) IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)
CTREPG	1855	S	36	36	1400	993

DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
NED	N	N	N	N	21FEB79

(28) REMARKS

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	550	U	62	1400	67466											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
CITY OF DANBURY	W.B.RIDER	

(49) REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(52) INSPECTION BY	(54) INSPECTION DATE DAY	MO	YR	(55) AUTHORITY FOR INSPECTION
LOUIS BERGER + ASSOCIATES, INC.	14	NOV	78	PL92-367

(56) REMARKS